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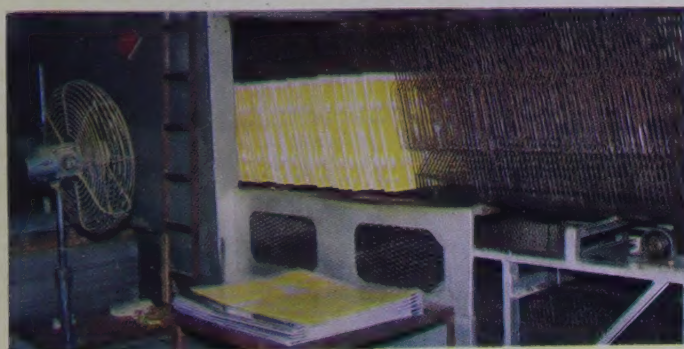
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Automatic Tin/Metal Printing Travelling Oven



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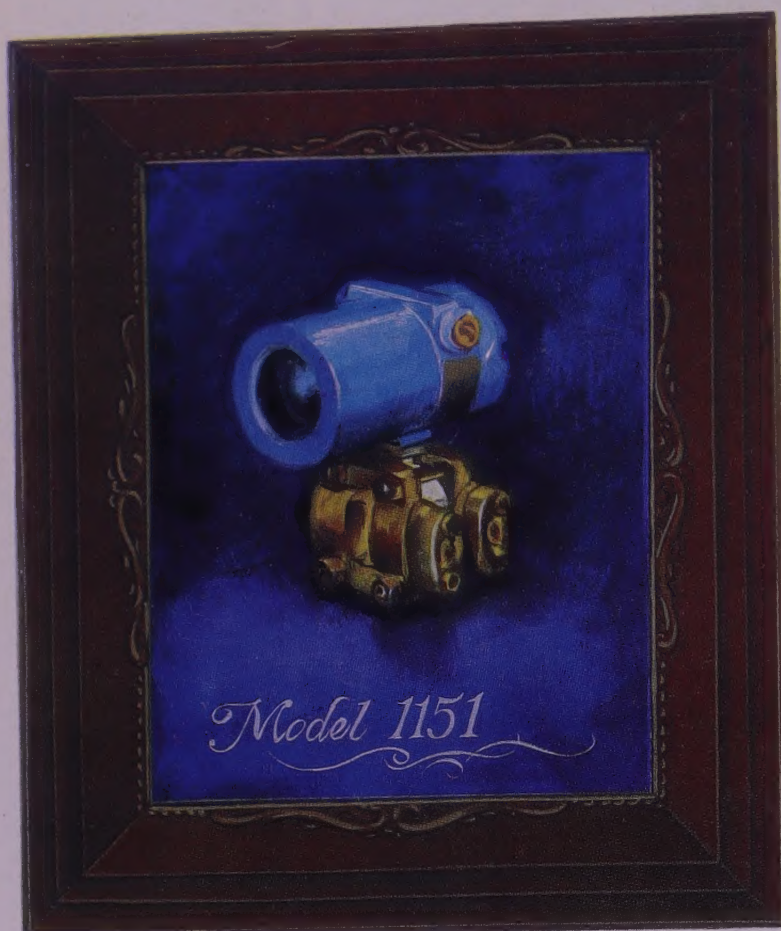
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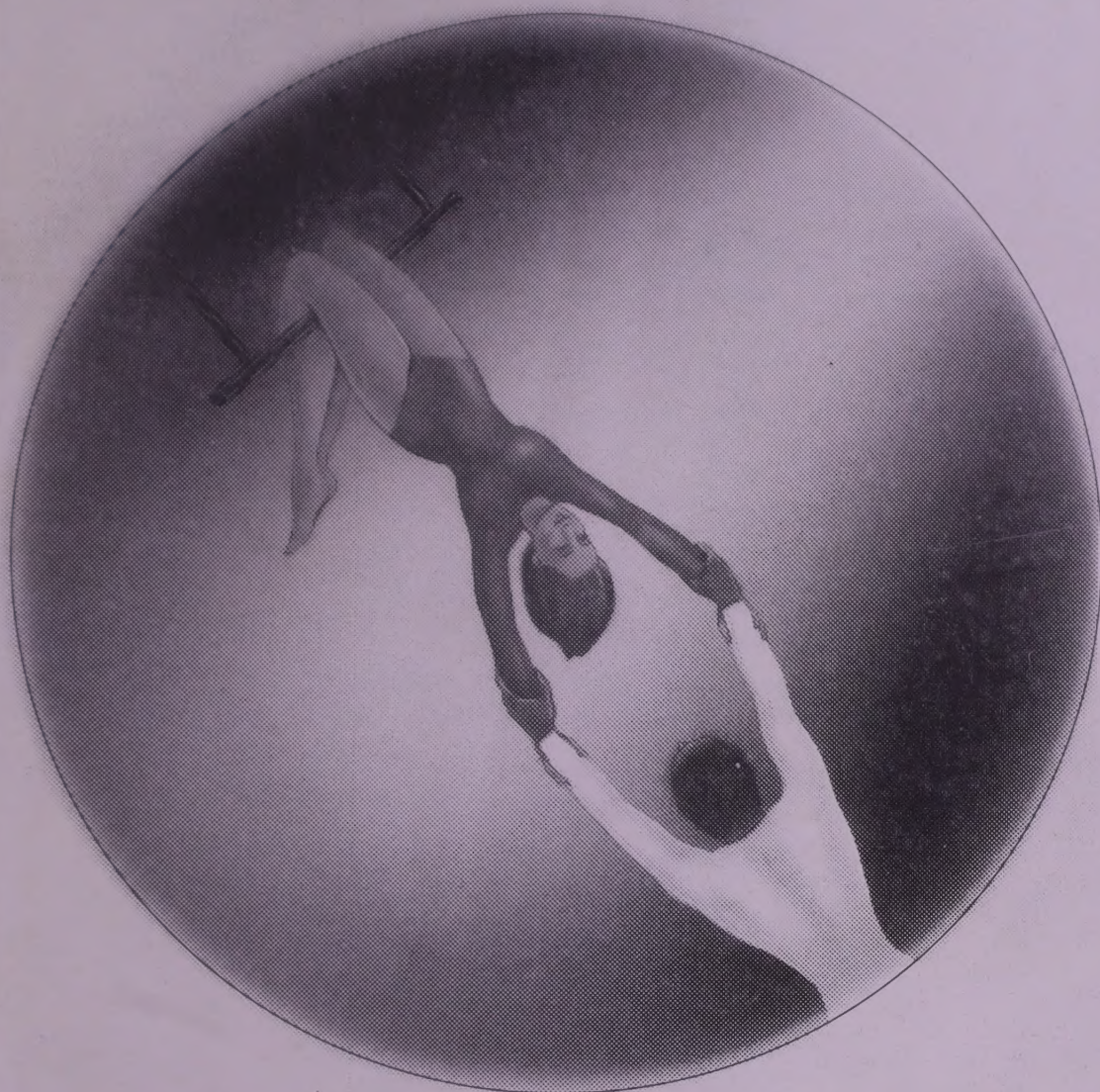
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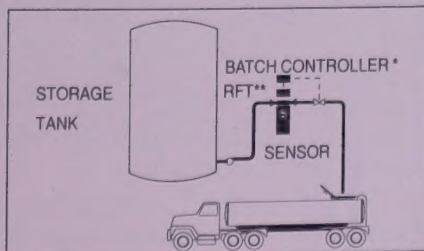
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ON FIRM GROUND

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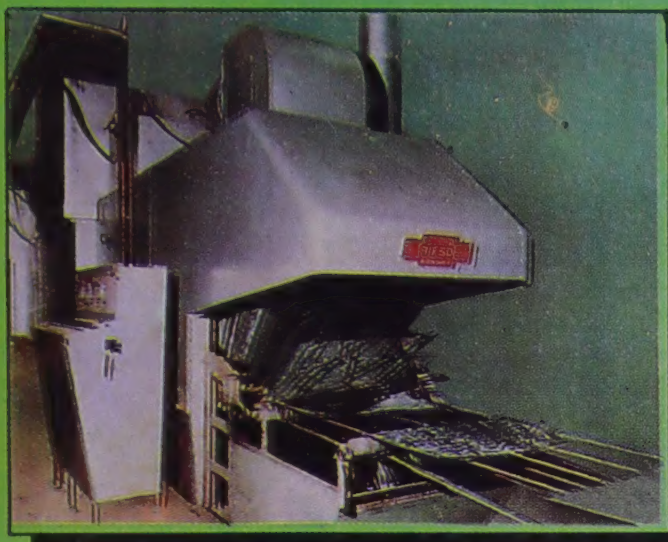
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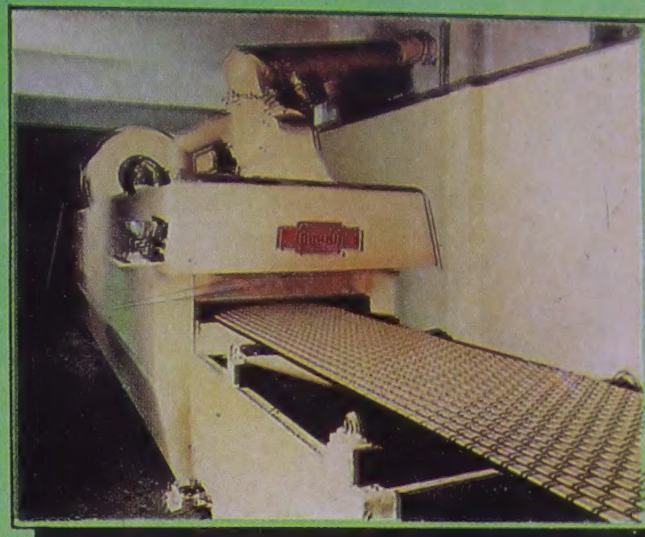
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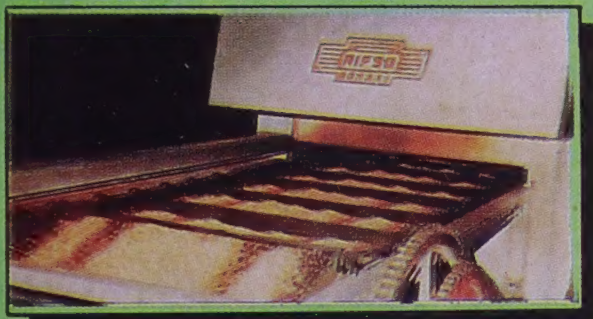


BISCUIT/BREAD BAKING OVEN

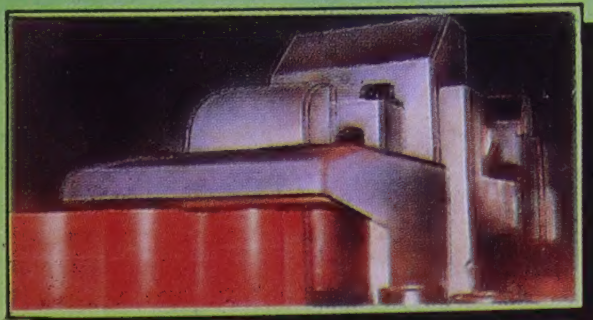
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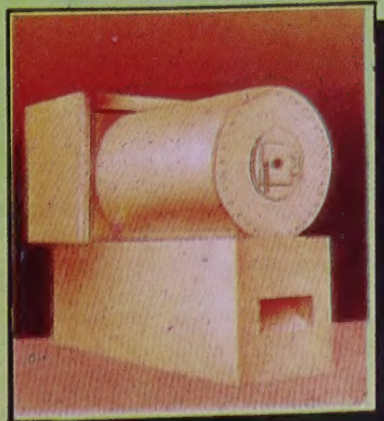
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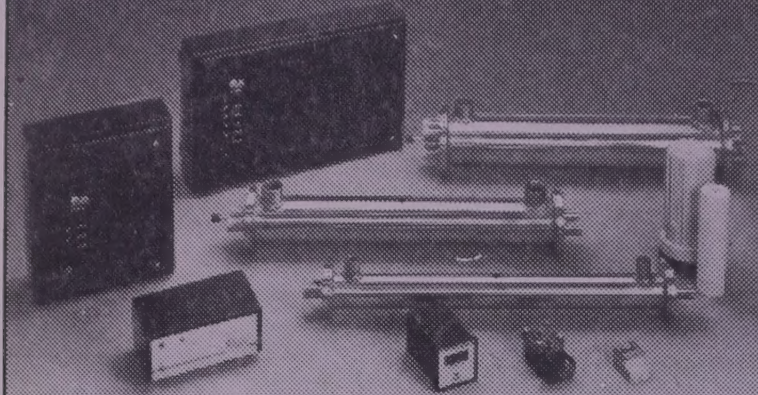
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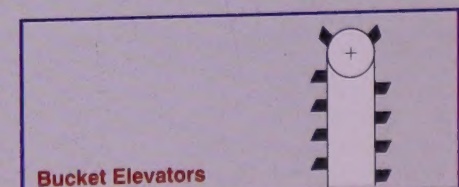
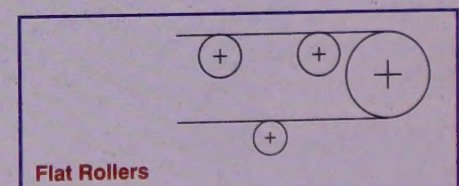
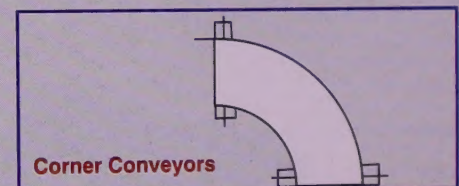
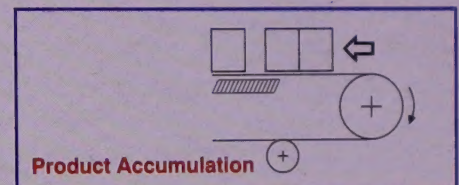
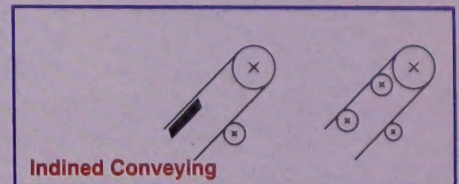
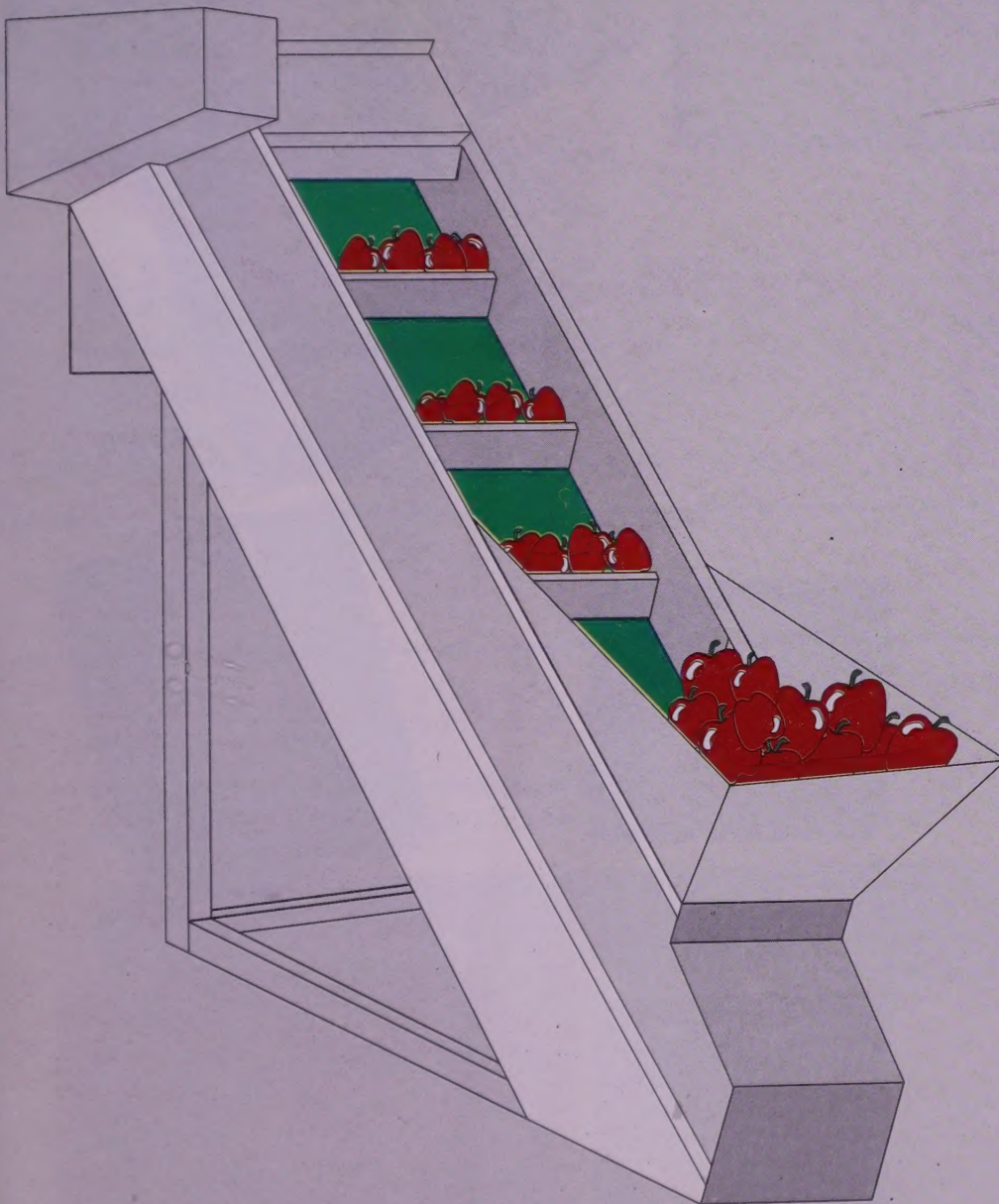
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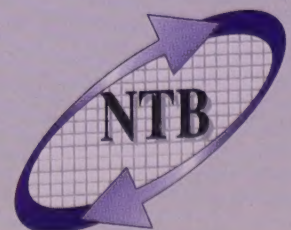
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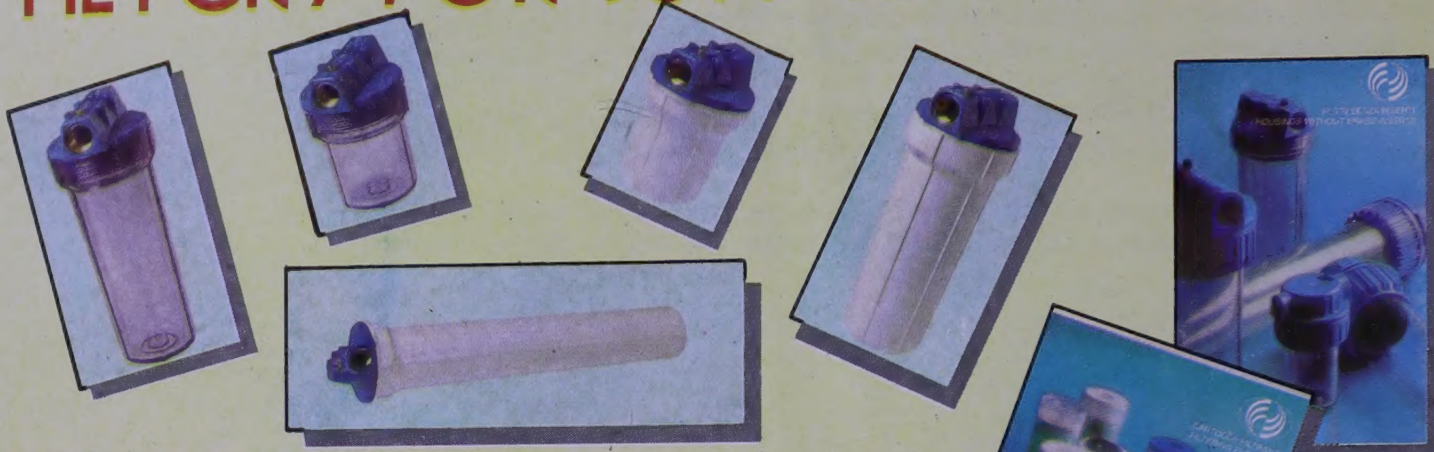
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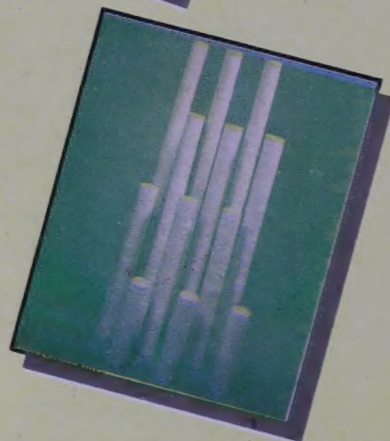
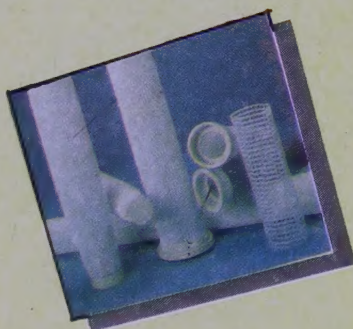
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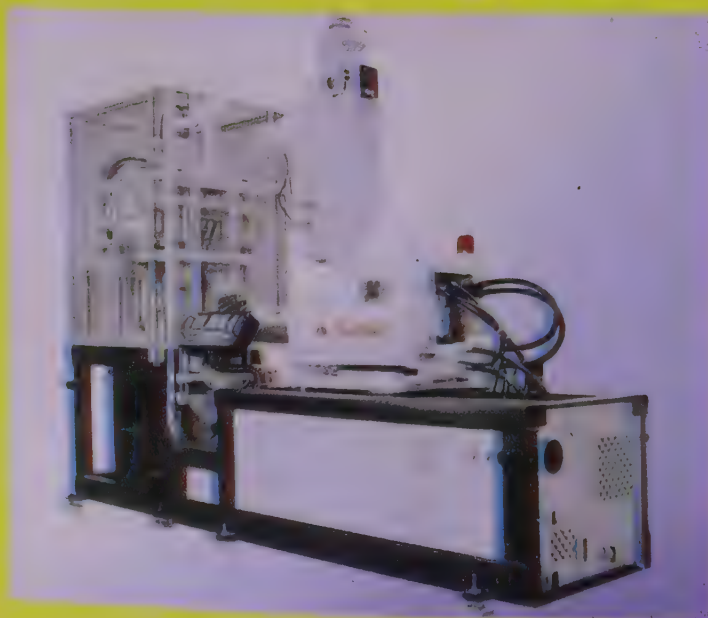


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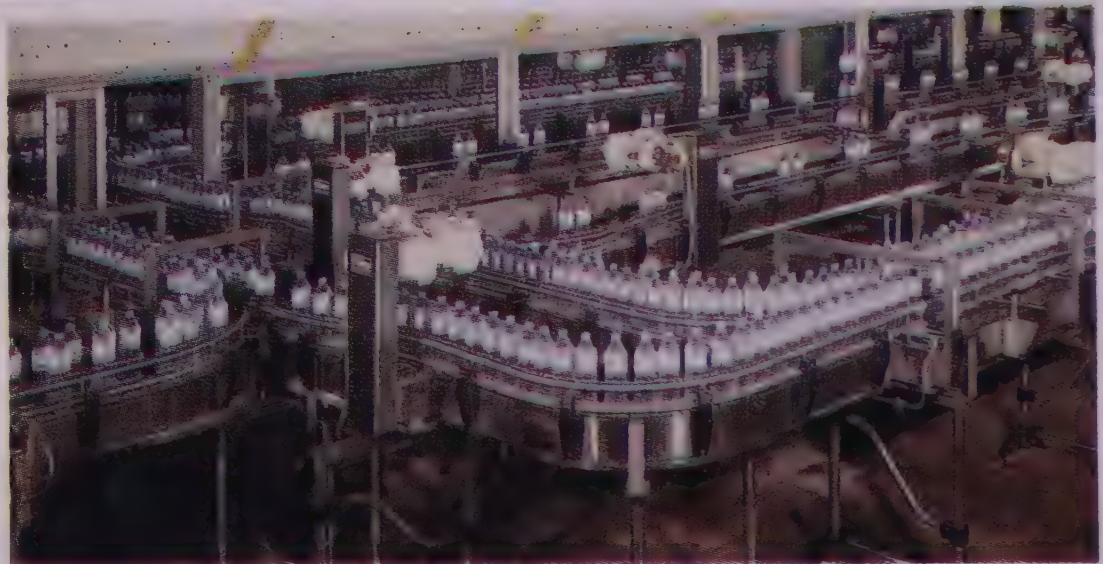
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Editorial...

Increasing urbanisation, busier lifestyles and more women in employment have influenced the rapidly growing food industry. Greater consumer demand for convenience is reflected in the growing demand for prepared foods that are easy to store, prepare and eat. Rising demand for convenient, traditional food, growing popularity for western foods such as salad dressings, yoghurts and sauces, demand for innovative products, increasing consumer awareness of healthy and functional foods are reflected in food products introduced in the world markets. Also a noteworthy trend is the increasing importance of organically-grown produce. Organic food can be defined most simply as produce grown without the use of pesticides, growth regulators, and man-made fertilisers.

In addition to convenience, new product activity continues to be apparent in food with beneficial health benefits. The concept of 'functional' food (or drink) with special health benefits (products for people with metabolic disorders, deficiencies or specific nutritional requirements such as the elderly and sportsmen, infant milk formulae, etc.) is increasingly popular worldwide. Ingredients include oligosaccharides, fatty acids, minerals, phytochemicals, anti-oxidants, vitamins, sugar alcohols, amino-acids, specific peptides and proteins, lactic acid bacteria and ofcourse - dietary fibres.

The ability to create and match new flavours, ingredients and additives to local palates, economic conditions and dietary habits is instrumental to the success of many leading suppliers of flavours, additives and ingredients. Ingredient companies are intensifying ties with local food and drink manufacturers and joining forces in product innovation and development.

Participation in exhibitions and trade fairs give manufacturers greater exposure and serves to enhance corporate and brand image in the market, besides developing contact with current and potential customers, as well as to find out about perspectives on taste and to learn how to use their resources and technical skills to help processors develop innovative products which will allow them to remain competitive in a rapidly changing market.

Indian Gum Industries of Bombay exhibited its premium food grade 'Edicol' and 'Stamulcol' guar gums and stabilisers in the **FI Asia '96** Exhibition held in Hong Kong in March. **Indo-Dutch Proteins Ltd.** of Hyderabad, a newly established egg processing plant, specializing in frozen and spray dried egg products, **Kancor**, an ISO-9001 registered manufacturer of spice oleoresins/oils, essential oils, natural colours, herbal extracts, **Roha Dychem**, a source for world class quality Idacol brand food colours in powder, granular and cake forms, **Synthite Industrial Chemicals Ltd.** of Kolenchery, Kerala Dist., manufacturer of spice oils, oleoresins, natural food colours and resinoids, commanding over 50% share of exports of these products, also made their presence felt at FI Asia Ltd.

India consumes one-third of the world spices and demand for premium spices, which is still low at the moment will continue to grow in tandem with purchasing power. Though spice fetches a higher price in the domestic market, Indian spices producers should develop a more sophisticated value-added spices processing industry targetted at export. India offers the advantages of a competitive work force, relatively low production costs and a huge domestic market. Many manufacturers of end products, with ISO certifications and the Spices Board Logo, are already exporting their products to Europe, the Middle East, Japan and the United States.

 Editor

Enzymatic Hydrolysis of Wheat Gluten to improve the functional properties

The modification of proteins is becoming ever more important for versatile use in the food industry. Skilful protein modification brings about higher solubility, increased whipping volume and improved emulsifying behaviour. The advantages of enzymatic protein modification will be explained here by the example of wheat gluten.

The effect of proteinases in influencing dough rheology derives from enzymatic hydrolysis of the gluten skeleton. In a similar manner, wheat gluten can be subjected to enzymatic modification so that hydrolysates with new, improved functions are created.

Wheat gluten is traditionally used to increase the baking capacity of wheat flours low in gluten. Specific protein hydrolysis enables the use of this vegetable source of protein in many applications in the food and feedstuff sectors.

The low solubility of native wheat gluten makes it unsuitable for almost any purpose. So the primary objective of proteolysis is to increase the solubility of the viscoelastic gluten over the entire range. Gluten hydrolysates are difficult to produce due to the viscousness of the substrate. In particular, achieving a precise pH adjustment by adding alkalis and acids is practically impossible. Enzyme products which are optimally active in the natural pH range of gluten (pH 6-6.5) are therefore preferred. Even at low doses of only 0.05 to 0.1 per cent (on protein), this enzyme ensures high degrees of hydrolysis of 10 per cent. This means that the protein macromolecule is split by the enzyme into oligopeptide fractions with an average chain length of 10 amino acids. Compared with native wheat gluten, the solubility of this hydrolysate is many times better, so it can now be added to a variety of foodstuffs. A pleasing side effect is the perfect taste of the product.

Bitter peptides are oligopeptides with a molecular weight of 1000 to 5000 daltons with a high content in hydrophobic amino acids. If these high-molecular-weight compounds are shortened from the chain end, the negative effect on taste can be countered. In this context, milk proteins such as casein and whey proteins in particular are endangered.

Wheat gluten treated with this enzyme

foams much better than untreated gluten. The foam volume is increased by approximately 30 per cent. The foam stability of the hydrolysates increases to the same extent.

Moreover, the emulsifying capacity of wheat gluten can be increased by approximately 30 per cent with the aid of proteinases. One gram of a wheat gluten hydro-

lysate is then able to emulsify 400 ml sunflower oil before the emulsion collapses.

As described here by the example of wheat gluten, the properties of various proteins of animal and vegetable origin can be deliberately modified so that new applications can be opened up for these products.

Enzymes for Bakery Products

No two flours are the same - any more than crackers are the same as biscuits or rolls the same as wafers. So continuous production of fresh, long-life, crisp bakery products is only possible with custom-tailored enzymes. For the miller these have to fulfil completely different functions than for the bread improver manufacturer or in the baking industry. This overview shows which enzymes do what at which stage of production.

Enzyme products for the mill

Fungal alpha-amylase products can correct flours with poor rising capacity so that fluffy doughs with reduced proving time and improved properties in the baked goods can be achieved. In the case of "short" gluten structures it is advisable to add a fungal proteinase too. Certain enzyme products increase the proving stability, prolong freshkeeping, and are used for treating rye flour or adjusting biscuit, cracker and wafer flours.

Amylases

Free-flowing fungal alpha-amylase products for correcting flours (wheat and rye flours) with poor rising capacity, gives fluffy doughs with reduced proving time and improves the properties of the baked goods (volume, pores, crust).

Other amylases have the same properties but with standard proteinase activity, for flours with poor rising capacity. They increase dough extensibility.

There are also special alpha-amylase products with dual activity, i.e.

1. enhances rising capacity (maltose formation)
2. prolongs freshkeeping (dextrin forma-

tion).

Other amylases products are used for high dough and proving stability and a particularly high baking volume; besides special enzyme products for particularly dry and stable dough characteristics;

Proteinases

Proteinase products contain specific softening properties for hard gluten structures and are used as a mill additive; for biscuit and cracker flours. These make the dough pliable.

Pentosanases

Some pentosanase products are used for high-amylogram rye flours from dry harvest years, works on the rye gums and reduces the dough viscosity. Prevents crumb detachment from the crust and lightens the crumb.

Other enzymes for dough systems containing rye flour, produces dry and very stable dough characteristics.

Enzyme products for bread improvers

By using enzyme products in the manufacture of bread improvers, it is possible to influence the flour constituents which are important for the properties of the baked goods and to offset natural fluctuations in the alpha-amylase content, for example. The addition of proteinases affects the rheological properties of a dough, which stem mainly from the quality of the gluten protein. Enzyme products for extended freshkeeping, to replace bromate, for the frozen dough and retarded dough processes, for increasing proving stability and oven rise as well as for rye flour dough

Contd. on Pg. 23

Spice Oils and Oleoresins

by

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Spices are highly aromatic mainly due to the presence of essential oil contents. Essential oil is a volatile mixture of organic compounds and its content varies from spice to spice. For purposes of extraction economically, it is more appropriate to use that particular part of the plant which has the maximum essential oil content. Essential oils are usually obtained by steam distillation of ground spices. It may also be obtained by hydro-distillation. In clove and cinnamon the oil is extracted from whole spices. Spice oils are extensively used in flavouring processed meats, soups, sauces, pickles, baked goods, soft drinks, liquors and in pharmaceutical and perfumery industry.

Spice oleoresins are the concentrated products, obtained by solvent extraction method and contains all the flavour ingredients soluble in that particular solvent used. Oleoresin contains volatile oil which gives aroma and non volatile resinous materials including pungent and other taste principles. Since they are usually soluble or dispersible in oil and fat, they can be used directly in fatty products like oil based dressings and sauces, processed meats, canned foods, etc.

Oleoresins are prepared in three stages. In the first stage, spice raw material is ground to the required fineness. Then it is extracted with solvents like alcohol, acetone, hexane, methylene bromide, ethylene dichloride etc. Finally, the miscella is distilled to get the quality end products. A less commonly used process for making oleoresin, to cater to the specifications of buyers, is to first obtain the volatile oil from the spice raw material by steam distillation, then to dry the residue and extract with a selected solvent. The recovered extract and the volatile oil are then mixed in any proportion, to get the oleoresin of desired level. This mixing is done when the extract is still warm to facilitate proper blending. However, this process increases the processing cost.

Spice extractives are free from microbial insect and rodent contamination. The products give uniform and stable flavour and are generally stable over longer periods of storage with less space.

India started producing spice oils and

oleoresins on a commercial scale only in the late sixties. Today, there are more than a dozen major manufacturers. The total production capacity of these units is estimated to be around 1500 tonnes and the production about 700 tonnes. Almost 99 per cent of the production is exported and only a small portion is used in bakery and confectionery industry. Today export of spice oils and oleoresins together with value added spice products contribute to a share of about 10 per cent of the total exports. These are exported to about 18 developed countries of the world. The major importers are USA, Germany, the U.K. and the Netherlands. Pepper oil and pepper oleoresin are by far the major items of export of spice oils followed by ginger oil, pepper oleoresins accounts for about 50 per cent of the total export of spice oleoresins followed by turmeric oleoresin and chillies oleoresin. The export of spice oils has shown a declining trend during the last one decade mainly due to the declining export of ginger oil. Ginger oil export which once contributed to over 50 per cent of India's export of spice oils, is now only about 10 per cent. Pepper oil export has steadily increased and it is now about 50 per cent of India's export of spice oils. Export of spice oleoresins has been increasing steadily and the increase is attributed to increase in the pepper oleoresin export.

Pepper Oil

The characteristic spicy odour of pepper is due to the presence of volatile oil in the cells of the pericarp of the berry. Pepper is grounded to a fine powder. To avoid loss of oil, it is distilled as fresh as possible. On steam distillation of the ground pepper for about six to eight hours a colour-less or pale greenish essential oil is obtained. The taste is mild and the yield varies from variety to variety. On an average it varies from 2.0 to 3.5 per cent. It is reported that as much as five per cent essential oil may be obtained when pepper from a good cultivar is chosen for the purpose. Pepper oil contains 70 to 80 per cent of monoterpenes and 20 to 30 per cent sesquiterpenes.

Pepper Oleoresin

Pepper oleoresin contains volatile oil and piperine, the major constituent respon-

sible for the biting taste. It is obtained by solvent extraction of ground pepper. Pepper which is plucked before it is fully mature, known as 'Half Pepper' in trade is generally used. High yields of oleoresin 12 to 14 per cent containing 19 to 35 per cent volatile oil and 40 to 60 per cent piperine are obtainable with good quality pepper. Pepper oleoresin is a viscous heavy liquid with strong aromatic odour. It is dark green or olive green in colour.

Cardamom Oil

Dried seeds in cardamom capsules are the source for essential oil of cardamom. Since the husk does not contain any significant amount of oil, it is separated before distillation of seeds. It can be extracted from both small and large cardamom. Decoricated seeds are crushed and powdered before distillation. In small cardamom, distillation takes about three hours. It is a colourless volatile oil easily soluble in alcohol. In large cardamom, distillation takes eight hours to give yield which varies from two to five per cent. It is pale yellow in colour. Composition wise small and large cardamom oils differ and therefore one cannot be substituted for the other. Large cardamom oil has limited use owing to very harsh aroma and inferior flavour. Cardamom oil loses the characteristic flavour on long storage.

Cardamom Oleoresin

It is obtained by solvent extraction of ground seeds of small cardamom. It is dark green containing 70 to 75 per cent volatile oil. Cardamom oleoresin is not generally produced commercially.

Ginger Oil

The volatile oil of ginger is produced by steam distillation of coarsely ground dry ginger with skin intact [it is reported that the recoverable volatile oil in the skin varies from 0.8 to 4 per cent]. Ginger takes a longer time for distillation, due to the presence of large amounts of high boiling constituents. It is important that the ground material is subjected to distillation without delay as loss of volatile oil and deterioration due to oxidation is rather rapid in ginger. Distillation time varies from six to eight hours to as many as 20 to 30 hours.

The yield of oil varies from 1.5 to 3.5 per cent depending on the varieties. Higher yield of four per cent has been recorded for ginger harvested at an early maturity. Ginger oil is a pale yellow viscous liquid. The best quality oil can be obtained from the fresh and freeze-dried ginger, but it is not practicable for the reason that the fresh ginger requires many hours of distillation due to the slow release of oil and freeze drying is costly.

Ginger Oleoresin

Ginger oleoresin has the aroma and pungency contributed by the volatile oil, gingerols and other non-flavour compounds. Mechanical drying of stored ginger is said to preserve the fresh aroma quality. The oleoresin from such dried material is distinctly lemony and fresh compared to the other from the dry whole ginger. Oleoresin is obtained by solvent extraction of the powdered dry ginger. The yield varies from 4.5 to 6 per cent. The volatile oil constitutes 25 to 38 per cent and gingerol accounts for about 20 to 30 per cent. Ginger oleoresin is a pleasant dark brown viscous liquid.

Turmeric Oil

Turmeric oil is extracted by steam distil-

lation of dry turmeric powder. It generally yields 1.5 to 4.0 per cent volatile oil. The oil is pale yellow to orange yellow and has an odour reminiscent of turmeric fingers. Distillation takes a long time. About 58 per cent of the oil is composed of turmerones and nine per cent tertiary alcohols.

Turmeric Oleoresin

Turmeric oleoresin is obtained by solvent extraction of dry turmeric powder followed by vacuum concentration. The product obtained using good, clear turmeric is a highly viscous deep brownish orange product. On an average, it contains 18 to 25 per cent volatile oil and 30 to 40 per cent of curcumin, the yellow pigment.

Chilli Oleoresin

It is obtained from solvent extraction of nicely powdered chillies. Varieties which have low seed content and free of calyx and stalk are more suitable for purpose of extraction. Yield of oleoresin varies from 12 to 16 per cent. Pungent principle in chillies is an alkaloid called capsaicin which is about one to four per cent.

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Pectin and its Manifold Applications

by

Citrus Colloids Ltd., Hereford, England, UK

Pectin is a natural component found in most land plants where, in combination with other structural components such as cellulose, it acts as a strengthening and cementing material giving texture to the tissue. Pectin is an extremely versatile ingredient which is used to improve the quality of food and pharmaceutical products. Traditionally used as a natural gelling agent, pectin is well accepted and consumer friendly. Its benefits are numerous.

Pectin is a naturally linear polysaccharide, based on a polygalacturonic acid, partially esterified with methoxyl groups. The amount of Methoxylation is very important as it influences the behaviour of the pectin and is defined as the average number of methoxyl groups as a percentage of the galacturonic acid units. This is commonly called the "Degree of Methoxylation" or DM and is used to classify pectin. High Methoxyl or HM pectins have a DM of 50% or higher. Low methoxyl or LM pectins have a DM of 50%. The behaviour of these pectins can be moderated by the introduction of another group called the Amide group. The Degree of Amidation or DA is quantified as the average number of Amide groups as a percentage of the galacturonic acid units. Typically it is the Low Methoxyl pectins which are amidated, resulting in two possible sub-groups, Conventional or Amidated LM, but amidated HM pectins are also manufactured.

The potential applications of pectin are extensive. Each application requires a different pectin.

Pectin in Jams, Marmalades & Jellies

Pectin is a vital ingredient in the production of retail jams, marmalades and jellies, providing additional gelling power to the existing ingredients. These products can be separated into 4 distinct groups:

- Preserves of soluble solids of higher than 60%
- Reduced sugar jams of soluble solids of between 45 and 60%
- Low sugar jams with a soluble solid content of less than 45%
- Less than

D. No added sugar products typically of 60% soluble solids or less, where concentrated fruit juice replaces the sugar.

In products where the soluble solids are above 60% and the pH is in the range of 2.8 and 3.5, High Methoxyl pectins are commonly used, while reduced and low sugar products are gelled with Low Methoxyl Pectins.

The inclusion of low levels of an appropriate Low Methoxyl pectin in both high and reduced sugar products can develop a high temperature viscosity which reduces the risk of fruit flotation, avoiding the need for other hydrocolloids.

Bakery jams and fillings must be pumpable with good reformation, and may have to exhibit bake stability or heat reversibility as required. High Methoxyl pectins have traditionally been used when the soluble solids are above 65%, to produce bake resistant jams. Low methoxyl pectins are also used in these areas to increase pumpability as well as reduced sugar fillings for bakery products. These products can also be manufactured by cold setting systems. When producing bakery glazes the heat reversibility of buffered amide pectins is of great advantage.

Pectin in Confectionery

Within the extensive range of confectionery, there are a number of areas in which pectins can be used to advantage.

The first is the fruit or acidic flavoured jellies, which traditionally use High Methoxyl pectins, to develop a smooth tender jelly with excellent flavour release.

The second is the neutral flavoured jellies such as Turkish Delight, which also have a tender bite, superior clarity and excellent flavour release.

A third area is a jelly or thickened filling for depositing directly into chocolate which can be prepared either by reducing the setting temperature of an existing product or by producing a pumpable filling or pseudogel for cold depositing.

Pectins have several advantages over

other hydrocolloids in these products, in that they create a fine textured elastic gel which has a clean breaking edge, exceptional eating quality and excellent flavour release.

In addition, pectin is resistant to thermal degradation during production, especially under acidic conditions, and offers rapid and controllable setting characteristics which are compatible with both batch and continuous processing.

Pectins are compatible with most other hydrocolloids, extending the variety of textures from a firm chewable gel to a thickened aerated filling.

Pectin in Fruit Preparations

Fruit preparations encompass a broad collection of products designed for use in yogurt, fromage frais, multi-layered desserts, ice creams and sorbets or as fruit sauces, topping sauces, compotes and fillings.

Typically LM pectins are employed to thicken these products over an extensive range of soluble solids, pH and fruit content as required for the specific application.

Pectin has several advantages over other hydrocolloids in these products. LM pectins create a smooth thixotropic texture, sufficiently strong to ensure uniform fruit distribution during storage, transport and use, but allowing easy pumping and mixing of the preparation without risk of damage to the fruit.

The behaviour of the fruit preparation is again determined by the influence of the recipe parameters on the pectin, in addition to the process conditions.

Due to the typically low soluble solid contents of such products, LM pectins are most commonly applied, although HM pectins may be used in the higher solid systems. Two pectin systems may offer further advantage to these products, where the main pectin develops the final texture once cooled, but a second pectin, at a very low level, introduces a high temperature viscosity preventing fruit flotation during

production. This avoids the need for other hydrocolloids, which may reduce the quality of the preparation by introducing an undesirable mouth-feel and reducing the flavour release, and may demand a more complicated label.

Pectin in Dairy & Desserts

The demand for increased variety, convenience and luxury in ready prepared desserts and in novel drinks has encouraged extensive development of both traditional, new and sophisticated products.

By using the naturally present calcium in milk and related products such as yogurts, fromage frais, fermented milks, buttermilks, soya and whey, pectins can be used to create a wide spectrum of textures in a broad range of desserts from thickened (e.g. custards) to firmly gelled (e.g. creme caramel) to aerated (e.g. whipped yogurt). Pectins are compatible with most other hydrocolloids to broaden these possibilities even further. In yogurt manufacture combining Low Methoxyl pectin with the milk prior to inoculation and incubation enhances the texture and mouthfeel of the final yogurt.

Specially prepared High Methoxy pectins are used to prevent adverse curdling reactions during acidification of milk e.g. when mixing juice with milk, or during subsequent heat treatments of acidified milk drinks or desserts, required for extended shelf life.

Gels based on water such as trifle jellies show distinct advantages over other hydrocolloids when prepared using Low Methoxyl pectins, such as improved clar-

ity and flavour release, good stability for processing, a controllable setting temperature and flexibility in texture. The jelly can be filled hot to set on cooling, or the jelly can be prepared earlier having been cool-stirred to create a thixotropic texture which is easily pumped but rapidly reforms a gelled structure able to support secondary layers almost immediately.

Pectin in other applications

Other applications include:

1) Sauces & Dressings (Savoury & Sweet) and Glazes (using LM pectins) e.g. Mint Jelly, No oil salad dressing, Cranber-

ry Sauce, Cumberland Sauce, Sweet & Sour Sauce, Tomato Sauce, Tomato Aspic, Barbecue Glaze/Sauce for meat etc.

2) Frozen water based Desserts or Drinks e.g. Ice Lollies, Sherbets & Ice pops.

3) Soft Drinks - for enhancement of the mouth-feel in low-calorie and low juice content drinks.

4) Concentrated juices & syrups - to keep pulp and oil in suspension - resulting in extended shelf life.

5) Pharmaceuticals and

6) Cosmetic preparations.

Enzymes for Bakery Products

Contd. from pg. 19

systems round off the range of products for bread improver manufacturers.

Enzyme products for long-life biscuit, cracker and wafer manufacturers

Primarily proteinase products are used in the manufacture of long-life bakery products. Their effect is to split, slacken or entirely break up the gluten network at the peptide bonds. The degree of peptide splitting depends on the type of enzyme used (fungal, bacterial, vegetable proteinase), the concentration and the reaction time (= dough resting time). In the long-life bakery product industry there is no dependence - as in the manufacture of yeast-

leavened products - on the gas retention capacity of the gluten, so bacterial and papain proteinases are normally used. This means that rapid dough relaxation and short resting times can be achieved.

The constant optimisation of old and new products, the continuous adaptation of the range to customer demands and, last but not least, the steady development of special enzymes may lead to such a variety of products that, instead of presenting to the customer a sales range which is clear at a glance, all that remains is a confusing proliferation of different products.

For this reason, the sales ranges have to be "groomed" from time to time in the field of enzymes for the beverage industry, products no longer corresponding to current demands have to be removed from the range or replaced by alternatives.

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Nutraceuticals - Foods of the Future

by

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Recent times have witnessed a large scale transformation in beliefs, values and attitudes. The food industry which is no exception has radically adapted itself to the changing world. The consumer preferences are changing fast with increased awareness regarding nutritional and health properties of foods. Recent surveys have revealed that consumers are increasingly making connections between diet and health (Anon., 1995). A few years ago people talked about removing food attributes like fat, sugar, cholesterol etc. to enhance the nutritional value of the food product. However, now the latest buzzword is the principle of augmentation, that is adding to food in order to improve its nutritional profile. In recent years there has been a dramatic increase in the rate of development of specialised ingredients which could be used to provide foods with a physiologically functional role. These ingredients have been referred to as Functional Foods or Nutraceuticals. This concept originated in Japan where the current market for Functional Foods has been estimated to be 2.4 billion pounds (Clutton, 1995). At present most of the products being marketed as Nutraceuticals are soft drinks, but the potential sectors include dairy products, confectionery and ready meals. These foods should not be considered as special foods but as a part of regular diet. They have also been named as Bio Foods, Pharma Foods, Designer Foods etc. The exact definition of functional foods or nutraceuticals is not very clear. However we can safely define *Nutraceuticals* "as foods or any substances that may be considered as foods or part of foods and provide medical or health benefits, including prevention and treatment of disease" (Pszczola, 1993).

Some of the potential functional food ingredients are described below. The list is long but it cannot be termed as exhaustive keeping in view the new roles being imparted to food ingredients which we consume normally, unaware of their therapeutic value.

1) Dietary Fiber

Dietary fiber consists of plant material

which is resistant to hydrolysis by endogenous enzymes of the mammalian digestive tract. The initial interest towards the fiber as an important dietary constituent was stimulated by epidemiological studies which linked the lack of fiber in diet to chronic disorders such as constipation, diverticulitis, cancer of the large bowel as well as the risk of obesity, cardiovascular ailments and diabetes more prevalent in developed countries (Burkitt and Trowell, 1975). The most abundant forms of dietary fiber are found in or are associated with the cell wall of plants. These include structural compounds such as cellulose, hemicellulose, pectin and lignin. Others like phenolic compounds, phytic acid, maillard compounds, digestive enzyme inhibitors are produced (biosynthesized) by plants in response to injury or to prevent seeds from desiccating. The non structural polysaccharides includes various gums and mucilages associated with endosperm intercellular space (Southgate, 1976, 1982). Dietary fiber has unique physicochemical properties which elicit various physiological responses in the body. Some of its important properties are discussed below.

- Dietary fiber is not degraded enzymatically in the mammalian digestive tract. However, it is fermentable to varying degrees by the normal microflora of the large intestine. The microbial degradation may lead to the production of short chain fatty acids (SCFA) and lowers the pH of large bowel which in turn affect the activity of microbial enzymes. In addition microbial cells contribute to faecal bulk.
- The pectins, mucilages and to a limited extent hemicelluloses have high water holding capacity. Hydration of fibers results in formation of a gel matrix. This can raise viscosity of the gastrointestinal contents and as a consequence, lower the rate of gastric emptying, diffusion, and absorption of nutrients. The reduced mineral availability and electrolyte absorption associated with some diets high in fiber is undoubtedly due to the binding of above components leading to their increased faecal excretion.

- In vitro studies have shown that lignin, pectin and other acidic polysaccharides can sequester bile acids. Cellulose in contrast has little bile acid binding ability. The ability of fiber to bind toxic compounds has been proposed as a protective mechanism of fiber against gastrointestinal cancer (Barbara, 1989).
- The other physiological effects of dietary fiber include reduction of plasma cholesterol levels and reduction of glycemic response to a meal. Oats and Legumes, appear to be most effective in reducing plasma cholesterol levels in hyperlipidemic individuals (Pilch, 1987). The mechanism involved in hypocholesterolemic effect of fiber is not fully resolved but it has been proved that certain fibers increase faecal bile acid secretion, modify bile acid metabolism as well as delay lipid absorption from small intestine. (Barbara, 1989). The Recommended Dietary Allowance (RDA) for fiber is 25g per day. Many companies in developed nations are marketing drinks with added fiber. Recently a few brands like "Shape and Ribena" have been introduced in the European market by St. Ivel and Smith Kline Beecham respectively. In Japan fiber enriched drinks like FibeminiTM from Otsuka Pharmaceuticals and FibiTM from Coca Cola are in great demand. Its proprietary forms include ultracelTM from Watson Foods Inc. USA and NovoloseTM from National Starch and Chemical Company, USA.

ii) Lactoferrin

Lactoferrin is an iron binding whey protein. In milk it is present in an iron free form. It is also present in other body secretions like tears, saliva, mucous etc. Lactoferrin is a large molecule which consist of 691 amino acid residues joined end to end, which are then folded up in to a compact, globular structure. On the outside of this are attached two pieces of carbohydrates. It is the precise arrangement of the atoms within this globular molecule which controls the function of lactoferrin. It is able to bind iron so tightly that bacteria

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which need iron to grow are starved. It can also kill some bacteria, directly in a way that is not well understood. Besides iron (as Fe 3+) lactoferrin also binds many other metals including aluminium Al3+ with the same charge and size as iron. Since Al3+ has been implicated in Alzheimer's disease, lactoferrin could be of use in the removal of aluminium from sufferers of this disease. Lactoferrin is also able to block binding of apolipoprotein E (the protein which promotes the incorporation of cholesterol and other lipids into cells) to its cell receptor. Apparently it is due to the fact that one part of lactoferrin structure mimics a vital part in apolipoprotein E. The potential for use of lactoferrin as a therapeutic modality for dampening the hyperplasia associated with leukemia has been demonstrated (Mathur et al, 1996). Lactoferrin is presently being utilised in the manufacture of infant food formulations.

iii) Conjugated Linoleic Acid

CLA is a collective term that refers to a mixture of conjugated positional and geometric isomers of linoleic acid (cis-9, cis-12 octadecadienoic acid). Theoretically, a number of CLA isomers are possible with double bonds present at positions 9 and 11 or 10 and 12 or 11 and 13 on the carbon chain of linoleic acid. At each position the double bond can be in the cis or trans configuration. However, it is cis-9, trans-11 octadecadienoic acid which is considered to be the biologically active isomer responsible for the anticarcinogenic properties of CLA (Ha et al, 1990; IP et al, 1991)

CLA has been found both in dairy and non dairy products. However dairy products are the richest source of CLA. Ghee has been reported to have very high CLA content of the order of 25-28 mg/g of fat. Factors influencing the formation of CLA in ghee includes microbial fermentation during curd formation and increase in the temperature of clarification from 110 to 120°C. The presence of proteins during heating in some ghee processes, play an important role in imparting high CLA content to ghee (Aneja and Murthi, 1991). This is similar to the effect of WPC (Whey Protein Concentrate) in process cheese, where increasing WPC content of process cheese from 0 to 6% increased the CLA formation by 35%. (Shantha et al, 1992) In non dairy products meat from ruminant animals is the richest source of CLA. In above animals CLA produced by biohydrogenation in the rumen, pass to small intestine where they are absorbed

together with other fatty acids of dietary origin, reesterified and ultimately circulated to all parts of the animals (Christie, 1979). In case of nonruminants CLA may originate from dietary sources. CLA has been shown to inhibit, initiation of epidermal carcinogenesis in mice by 7, 12 dimethyl benz (a) anthracene (DMBA) (Pariza and Hargraves, 1985) and initiation of mouse forestomach tumorigenesis by benzo(a)pyrene(BP). (Ha et al, 1990).

iv) Calcium

Milk and milk products account for most of the calcium in our body system. There has been considerable efforts, to relate various disorders and calcium.

- 1) Calcium and osteoporosis: Bone decalcification is the main cause of osteoporosis a disease that occurs particularly in women over fifty years of age. It has been observed that adequate calcium intake during formative years help strengthen bones and reduce complications from bone fracture in later life.
- 2) Calcium and Blood Pressure: Research has strongly indicated that a substantial calcium content has a beneficial effect with respect to control of blood pressure (Anon., 1986)
- 3) Calcium and Colorectal Cancer: Epidemiological animal and human studies suggest a relationship between calcium intake and decreased risk of colon cancer. Presumably, protective effect of calcium relates to its ability to detoxify free fatty acids and bile acids.
- 4) Calcium and Premenstrual Syndrome (PMS): A study conducted on dietary habits of 33 women at Metropolitan Hospital, New York Medical College has revealed that dairy supplementation with 1000 mg of Calcium carbonate helped alleviate symptoms such as depression, headaches, mood swings, abdominal bloating and back pain (Mueckenhoff, 1992).

In Indian context many milk foods with fortified calcium labels have come up. These products include Horlicks™ and other malted milk foods. Elsewhere "Calcitrim" brand of milk products like flavored milk, acidophilus yoghurt with added calcium have been launched by Tetra Pak (New Zealand) Limited.

v) Medium Chain Triglycerides

Medium Chain Triglycerides are fatty acids composed of 6-10 linear carbon fatty

acids units. The calorific value of MCT is 8.3 Kcal/g, in contrast to 9 Kcal/g for long chain triglycerides (LCTs). The use of MCT is specially indicated for the following disorders of fat absorption and lymphatic drainage from the intestine, Pancreatic insufficiency, Biliary atresia, Chyluria, Chylous fistula, Celiac disease, Small bowel resection and Cystic fibrosis. MCTs are most commonly used in combination with LCTs. This combination provides essential fatty acids via the LCTs, yet retains the advantage of easy digestibility, absorption and metabolism of the MCTs. Although, MCTs and LCTs compete for absorption, the administration of the MCTs in conjugation with LCTs actually increases the total intestinal absorption of both compared with that of either alone (Bach and Babayan, 1982). MCTs are being incorporated as easily digestible source of fat in infant food formulation. Simyl-MCT is one such product currently being marketed in India (Sharma and Ganeshkumar, 1996).

vi) Omega -3-Fatty Acids

Fats are divided into two groups, saturated fats and unsaturated fats. The unsaturated fats are subdivided into monounsaturated and polyunsaturated fats. The Polyunsaturates consists of three groups containing Omega-9 (n-9), Omega-6 (n-6), and Omega-3 (n-3) fatty acids. Omega-3 and Omega-6 fatty acids are being classified as essential to human beings. The essential omega-6 FA, from which Arachidonic acid (AA) can be synthesized is called Linolenic acids (LA). The Omega-3 fatty acids from which Eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) is called alpha - Linolenic acid. Omega 3 fatty acids are present in abundance in fish oils. They have recently become important, because of their effect on lowering of risk of cardiovascular disorders, diabetes, multiple sclerosis and cancer. AA, and EPA/DHA are responsible for further production of metabolites called eicosanoids, which play an important role in different reactions in the vascular system and other bodily functions such as immune system. The recommended daily intake for a healthy individual is 350 mg of EPA/DHA, which corresponds to 30g fish per day. The number of products containing DHA and EPA has risen considerably in the past two years. This has been made possible by improved methods of deodorising the products, which can otherwise have a fishy off odour and flavour. Many companies have launched products containing omega - 3 - oils, initially fish based, but now also including meat products, health drinks, yoghurt, margarine,

biscuits and confectionery. Recently introduced products in European Union containing these fatty acids includes, TimlicTM and a lite cake from Nuricia. Dry n-3 from Dano Chem A/S in Denmark, a form of microencapsulated fish oil is being used for fortification in to Infant formulas, fruit bars, health foods etc..

vii) Mushrooms

In Japan, extract of speciality mushrooms such as Reishi and Shittake are taken in tablet form as an alternative to conventional drugs, whilst a number of drinks containing these extracts are also available. Presently two companies, Garuda Int. and Maruzen Pharmaceuticals Co. have excelled in this field. Research has shown that application of Reishi promotes deep slow wave sleep in insomniacs. It has also been used to treat neurasthenia, a condition common in Chronic Fatigue Syndrome, hypertension. Shittake mushrooms has 18 amino acids including seven of the eight essential amino acids. One of these, Eritadenine is believed to be responsible for it's ability to reduce cholesterol level in blood (Perkin, 1994).

viii) Antioxidants

One of the ways through which disease develop is the damage to DNA and lipids, that can be induced by free radicals, which are reactive molecules with an unpaired electron produced during normal aerobic metabolism. These radicals are normally scavenged and rendered innocuous by cellular antioxidants, many of which are vitamins or enzymes depending upon trace elements for their activity. The role of copper ions in the formation of hydroxyl radicals and subsequent cell killing has been established (Burkitt, 1994). Antioxidants especially Vitamin C, Vitamin E and carotenoids found in fruits and vegetables, afford protection against cancer and other cardiovascular ailments. Food contain many compounds with structure similar to these antioxidant Vitamins, with the ability to donate hydrogen atom and delocalise electrons. These include many polyphenolics and flavonoids. Quinol, catechol, catchin and chlorogenic acid have been found to be as potent as alpha-tocopherol in their antioxidant properties in vitro system (Duthie, 1994). Dietary intake of flavanoids can range from 25mg to 1g per day. They are present in substantial amounts in vegetables, fruits, cereals, tea, coffee, wine, beer and nuts; it is perhaps significant that many of these foods have been associated with low incidences of heart disease and cancer.

ix) Oligosaccharides

Oligosaccharides are most popular functional food component in Japan. The number of consumer products like soft drinks, cookies, cereals and candies containing oligosaccharides are increasing in Japan, where in the year 1990 alone nine different types of oligosaccharides worth \$46 million, were produced in Japan (Tomomatsu, 1994). Physiologically Functional (PF) oligosaccharides are short chain polysaccharides with unique structure (Fig 1) and meet two specific requirements.

1) they are not digestible by human digestive juices.

2) they are preferentially consumed by beneficial intestinal bacteria, bifidobacteria in the colon, for this function they are also called Prebiotic food ingredients. The benefits of oligosaccharide consumption arise from increased population of indigenous bifidobacteria. Incorporation of bifidobacteria instead of oligosaccharides into processed foods is quite difficult because of their high susceptibilities to oxygen shear, heat and acids. The effective daily doses of oligosaccharides (pure form) are 3.0g of fructooligosaccharide, 2.0-2.5g of galactooligosaccharides, 2.0g of soyabean oligosaccharides and 0.7g of xylooli-

gosaccharides. Several natural foods are known to contain oligosaccharides. For example, fructooligosaccharides can be found in onion, garlic, burdock, asparagus, chicory roots and other plants. Soyabean oligosaccharides are found in soyabean. However, judging from usual eating habits, it may be difficult to ingest the recommended daily doses of oligosaccharides from natural foods. Average daily ingestion of fructooligosaccharides from natural foods is estimated to be approximately 0.8g/day / 130 lb of body weight in U.S. (Spiegel *et al*, 1994). Currently few companies, like Zea Gen. Corp., Westminster, Colo., USA are marketing fructooligosaccharides in commercial form. In Europe, Inulin obtained from chicory is gaining importance. In 1994 "Biograde Yoghurt" with inulin and "Fyos fermented milk drink" with inulin and *L.casei* were launched by Mona and Nutricia Companies respectively. Health benefits from ingestion of oligosaccharides are listed in Table 1.

x) Probiotic

Public interest in the health aspects of fermented milk products especially yoghurt was spread world wide with the awarding of nobel prize to the Russian microbiologist Metchnikoff. He was aware of the importance of gastrointestinal microflora, and held that yoghurt had a beneficial impact on it. The term Probiotics has been used to describe living organism of host specific origin which can have a beneficial effect on health (Fonden, 1995). Lactic acid bacteria (LAB) and bifidobacteria are the main groups of bacteria used as probiotics, the common genera being *Enterococcus*, *Lactococcus*, *Lactobacillus* and *Bifidobacterium*.

Mode of Action

Research on the impact of probiotics on human health has started. Probiotic foods have proved to be good for lactose intolerants, people with gastrointestinal disorders. Some probiotic products increase the total number of LAB in faeces. They are inhibitory to the potentially pathogenic microorganisms by lowering the pH of large intestine. Probiotics aid in the reconstitution of normal gut microflora after antibiotic therapy. The role of probiotics in stimulation of immune system, lowering the risk of colon cancer and coronary heart disease is being studied. There are a lot of probiotic products currently in the market especially in European Union, USA, and Japan. Some of the products are listed in Table 2.

Table 1: Health benefits of Oligosaccharide Ingestion

Health Benefit	Mechanism
1) Proliferation of Bifidobacteria and reduction of detrimental bacteria and prevention of pathogenic & autogenous diarrhea.	i) By production of SCFA (LA & AA in 3:2 ratio) ii) Ability to produce high molecularwt. substances iii) Antibiotic bifidin produced by <i>B.bifidum</i> .
2) Prevention of constipation	i) High levels of SCFA stimulates peristalsis ii) Increasing faecal moisture with osmotic pressure.
3) Reduction of serum cholesterol	i) Changes in Intestinal microflora ii) <i>L. acidophilus</i> assimilates cholesterol iii) Production of Nicotinic acid.
4) Anticancer effect	i) Immunity enhancement by cell, cell wall components and extracellular components of <i>Bifidobacteria</i>

(Ref. Tomomatsu, 1994)

SCFA= Short Chain Fatty Acids

LA = Lactic Acid

AA = Acetic Acid

Outlook

Stringent government regulations hinder the entry of nutraceuticals into the market. The need of the hour is:

- * To prove beyond doubt, all the claimed health benefits of these products.
- * To carry out extensive toxicological and analytical studies on these ingredients & establish their safety.
- * To resolve the issue of labelling these products i.e. a food or a drug.
- * The consumer acceptability with regard to organoleptic attributes must be improved and the level of consumer

awareness about the potential of nutraceuticals must be increased.

- * Efforts must be made to aim at and reach out to specific groups of consumers.

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Table 2: Probiotic Products

Native Land	Probiotic Product	Organism Involved
a) Finland	i) A-Fil ii) Whey drinks	<i>L. acidophilus</i> <i>Lactobacillus GG</i>
b) Denmark	i) Gaio	<i>S. thermophilus</i> & <i>Enterococcus faecium</i>
c) Norway & Denmark	i) Cultura	<i>Bifidobacterium spp.</i>
d) Sweden	i) Dofilus ii) Verum Halsofil iii) BRA milk	<i>L. acidophilus</i> <i>Lactococcus lactis</i> <i>Bifidobacterium</i> <i>Lactobacillus reuteri</i> <i>L. acidophilus</i>
	iv) PRO VIVA	<i>L. Plantarum</i>
e) Japan	i) Bifidus milk ii) Mil Mil iii) Bifidus yoghurt	<i>Bifidobacterium longum</i> <i>L. acidophilus</i> <i>B. breve</i> <i>B. bifidus</i> <i>L. acidophilus</i> <i>S. thermophilus</i> <i>L. delbrueckii subsp bulgaricus</i> <i>Bifidobacterium</i>
f) Germany	i) Vifit yoghurt ii) LC1	<i>Lactobacillus GG</i> <i>L. acidophilus l</i>

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Effect of Incubation Time of Banana Pulp With Pectinolytic Enzyme on the Yield and Quality Characteristics of Juice

by

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Abstract

The objective of this study was to optimize the incubation time for the liquefaction of banana pulp with some pectinolytic enzyme preparations for juice production. The juice obtained after enzymic liquefaction had significantly higher juice yield, total soluble solids, total sugar, reducing sugars acidity and clarity of juice than control. The increase in incubation time upto 2 hours had a positive significant effect on the yield, total soluble solids, total sugars and reducing sugars and clarity of juice except acidity of juice and thereafter did not show any impact.

Introduction

The time required for pectinolytic liquefaction of fruit pulps depends upon the type of fruit, type of enzyme, enzyme concentration, incubation temperature and incubation time. Sreekantiah *et al.* (1971) incubated banana pulp for 16-18 hours at room temperature after enzyme treatment for juice extraction. Jaleel *et al.* (1978) studied the effect of incubation time on banana juice yield and its characteristics. They concluded that agitation of pulp for one hour after addition of enzyme was found beneficial for processing. Viquez *et al.* (1981) reported an optimum incubation period of 2 hours for enzymic liquefaction of banana pulp with ultrazyme.

Since the information on the effect of incubation time of banana pulp is scanty, the present investigation was therefore undertaken to study the effect of incubation time of banana pulp with pectinolytic enzyme preparation on banana juice yield and its characteristics.

Materials and Methods

Ripe banana fruits of Dwarf Cavendish variety were obtained from local market. Pectinolytic enzyme preparations, pectinase-500, Deepol-NCC, and Rohapect-TF were gifted by M/s Biocatalysts Ltd., Treporest Industrial Estate, Portypridd CF 37 SUT, Wales and M/S Rohan Ltd, 61-D Armstadt, Germany, respectively.

Banana pulp was prepared and treated with enzyme (1.5% V/W) as per the method described by the authors earlier (1994). The samples of enzyme treated pulp were incubated for 1 to 5 hours at an interval of one hour at 45°C. At the end of incubation banana juice was prepared from each sample according to the method described by authors earlier (1994). The juice yield was calculated and juice was analysed for physico-chemical characteristics.

Juice samples were analysed for total soluble solids, total and reducing sugars (Shaffer Somogy micro-method), and acidity (ascitic acid) by AOAC methods (1975). Juice clarity was determined by measuring transmittance of juice at 580 nm using distilled water as blank on Bausch and Lomb Spectronic 20 by the method of Viquez *et al.* (1981).

Table - 1: Effect of incubation time on the % yield of banana juice

Enzyme	Incubation in hours				
	1.0	2.0	3.0	4.0	5.0
Control	19.5	25.3	25.3	25.5	25.9
Pectinase-500	61.3	74.0	74.6	74.8	74.9
Deepol-NCC	64.9	72.0	72.0	72.3	72.3
Rohapect-TF	54.4	58.0	58.4	58.6	58.7

Values are means of triplicate estimations.
C.D. at 1% level of significance for the effect of incubation time = 1.74.

Table - 2: Effect of incubation time on the % total soluble solids of banana juice

Enzyme	Incubation time, hours				
	1.0	2.0	3.0	4.0	5.0
Control	19.00	19.00	19.00	19.00	19.26
Pectinase-500	21.26	21.90	21.93	22.03	22.63
Deepol-NCC	21.20	21.86	21.88	21.96	21.96
Rohapect-TF	20.90	20.96	20.96	21.06	21.16

Values are means of triplicate estimations.
C.D. at 1% level of significance for the effect of incubation time = 0.173

Table - 3: Effect of incubation time on the % total sugar of banana juice

Enzyme	Incubation time, hours				
	1.0	2.0	3.0	4.0	5.0
Control	11.06	10.80	10.86	10.80	10.76
Pectinase-500	11.38	12.70	12.70	13.10	12.53
Deepol-NCC	11.26	12.96	12.87	12.67	12.61
Rohapect-TF	10.67	11.03	11.60	11.60	11.58

Values are means of triplicate estimations.
C.D. at 1% level of significance for the effect of incubation time = 0.279.

Table - 4: Effect of incubation time on % reducing sugars of banana juice

Enzyme	Incubation in hours				
	1.0	2.0	3.0	4.0	5.0
Control	1.73	2.06	2.06	2.00	1.96
Pectinase-500	2.64	3.30	3.23	3.20	2.93
Deepol-NCC	2.76	3.43	3.43	3.20	3.20
Rohapect-TF	1.83	3.30	3.29	3.27	3.27

Values are means of triplicate estimations.
C.D. at 1% level of significance for the effect of incubation time = 0.179.

Table - 5: Effect of incubation time on % acidity of banana juice

Enzyme	Incubation time, hours				
	1.0	2.0	3.0	4.0	5.0
Control	0.67	0.67	0.67	0.79	0.79
Pectinase-500	1.00	1.01	1.01	1.02	1.02
Deepol-NCC	1.02	1.05	1.05	1.05	1.09
Rohapect-TF	0.98	0.98	0.98	0.98	0.98

Values are means of triplicate estimations.

Table - 6: Effect of incubation time on % transmittance of banana juice

Enzyme	Incubation time, hours				
	1.0	2.0	3.0	4.0	5.0
Control	35.66	46.66	48.33	49.00	49.00
Pectinase-500	88.36	90.33	90.33	90.16	89.76
Deepol-NCC	87.39	89.00	90.00	89.33	89.36
Rohapect-TF	77.70	78.33	78.33	78.33	78.70

Values are means of triplicate estimations.
C.D. at 1% level of significance for the effect of incubation time = 1.00.

Results and Discussion

Juice Yield and Total Soluble Solids

Juice Yield in control after different hours of incubation at 45°C ranged from 19.5 to 25.9% (Table 1). The juice yield increased significantly ($P < 0.01$) by increasing the incubation time upto 2 hours and thereafter it remained more or less constant. Jaleel *et al.* (1978) observed a constant increase in banana juice yield upto 4 hours of incubation, when 0.5% enzyme was added. However, they also observed maximum juice yield after 2 hours incubation when the concentration of enzyme was kept at more than 0.75%. The results of present investigation are in accordance with the findings of Viquez *et al.* (1981).

The total soluble solids of control after different periods of incubation at 45°C ranged from 19.0 to 19.26% (Table 2). The similar trends in the effect of incubation period was observed with respect to total soluble solids in banana juice except that the total soluble solids of juice prepared after 5 hours of incubation of pulp were significantly ($P < 0.01$) higher. Jaleel *et al.* (1978) also made similar observations.

Total sugars and reducing sugars

The contents of total sugar and reducing sugars of banana juice prepared without

any enzyme treatment ranged from 10.76 to 11.06% (Table 3) and 1.73 to 2.06% (Table 4), respectively. Addition of pectinolytic enzymes caused an appreciable increase in total as well as reducing sugars contents of banana juice. The content of total and reducing sugars increased significantly ($P < 0.01$) by increasing the incubation time upto 2 hours in the samples treated with Deepol-NCC and Rohapact-TF and upto 4 hours in the samples treated with Pectinase-500. Thereafter, the effect of incubation time was non-significant.

Acidity

The acidity of banana juice measured as % citric acid ranged between 0.67 to 0.70% without enzyme liquefaction of banana pulp (Table 5). The effect of enzymic liquefaction of banana pulp resulted in a marked increase in acidity of juice. The juice acidity remained unaffected by incubation time. Jaleel *et al.* (1978) also obtained similar results of enzymic treatment on acidity.

Juice clarity

The values of juice clarity (% transmittance) of control ranged from 35.66 to 49.0% (Table 6). Pectinolytic liquefaction of banana pulp appreciably improved the juice clarity. The juice clarity increased

significantly ($P < 0.01$) by increasing the incubation time. However, this increase in juice clarity was significant upto 2 hours in samples treated with Pectinase - 500 and Rohapact-TF and upto 3 hours in samples treated with Deepol-NCC. This showed that latter was slow in its activity as compared to former.

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Quality Characteristics of Chicken Loaves extended with Bengal Gram

by

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Abstract

Chicken loaves are a delicacy which offers an alternative avenue for utilisation of meat from spent hens. This product can be made available to relatively large segment of Indian population by extending meat with low cost vegetable extended. In the present experiment, chicken meat was extended with 5, 10 and 15% levels of Bengal gram paste in the standardised formulation. Since Bengal gram has a very good binding ability, no significant differences were observed in emulsion pH as well as stability and cooking yield as well as shear force value of chicken loaves. Sensory evaluation of the products showed a marginal improvement in general appearance and non-significant decline in juiciness and texture. Chicken loaves extended with 10 and 15% levels of Bengal gram showed a slight, yet significant ($P \geq 0.05$) decline in flavour and overall palatability. Still, the sensory evaluation of the product revealed good to very good acceptability.

Introduction

Meat loaves are ready-to-eat speciality item. Although add-to-ingredients vary widely, these are generally prepared from comminuted meat or meat byproducts. Proteins derived from a variety of plant sources are also used by the meat industry to reduce product cost and improve functionality. Kerr (1950) suggested that cereal binders can be used in comminuted products at various proportions to hold the meat tissues, its juices and fat together during cooking and storage. The addition of proteins and starches of vegetable origin to improve the binding properties of meat products, is a well established phenomenon (Price and Schweigert, 1971). Excellent binding is one of the important functions of Bengal gram in Indian food snacks.

Bansal *et al.* (1978) evaluated the ability of Bengal gram as binder in

chicken frankfurters with good results. Mahapatra *et al.* (1984) showed that moisture content was higher in gram flour extended chicken patties than maida extended patty. Stuff binding provided by Bengal gram paste in chevon-samosa at 10% addition was comparable to control having cooked mashed potato (Sharma *et al.*, 1988). The overall palatability scores of pork kofta were significantly higher ($P \leq 0.05$) due to addition of Bengal gram (Besan) paste at 5% level (Padda *et al.*, 1988).

However, this economically important and functionally valuable extender is yet to be extensively explored especially in meat derived from spent hens. The present study was undertaken to evaluate the effect of Bengal gram incorporation in various attributes of chicken loaves.

Materials and Methods

Bengal gram paste was prepared by adding water to Bengal gram flour. The mean moisture content of Bengal gram paste was 32.94 ± 6.58 percent.

White leghorn spent hens (>500 days old) were manually slaughtered and dressed. Deboning was done within two hours of slaughter. Lean chicken was minced first through 6 mm and then through 4 mm plate of a meat grinder. Control formulation of chicken loaves contained 67 parts of minced meat while Bengal gram paste was used to extend minced chicken by replacing its 5, 10 and 15 parts in the treatment formulations. In addition, each formulation contained ice flakes, 12, vegetables oil 8, bread powder 6, salt 2, dry spices 1.75 and condiments 3.25 parts. Emulsion preparation and stuffing in aluminium moulds were done as per Sharma *et al.* (1992). Cooking was done in hot air oven at 165°C for 2 hours. After cooking the loaves were cooled to room temperature, packaged in polythelene pouches and stored in refrigerator overnight. Slicing was

done on the following day. Three experimental trials were conducted.

Emulsion stability (Townsend *et al.*, 1968) and cooking yield as well as shear force value of loaves were recorded (Sharma *et al.*, 1992). Sensory attributes of chicken loaf slices were evaluated by experienced panelists using 8 point hedonic scale (Where 8 = extremely desirable and 1 = extremely undesirable). Representative samples of chicken loaves were chemically analysed for moisture, fat and protein (AOAC, 1980). Statistical analysis of data was done as per Snedecor and Cochran (1980). Least significance were calculated at appropriate level of significance.

Table 1. Effect on emulsion pH and stability alongwith cooking yield and shear force value of chicken loaves extended with Bengal gram (Mean \pm SE)

Level of Bengal gram	Emulsion pH	Emulsion stability (%)	Cooking yield (%)	Shear force value (kg/cm ²)
0%	6.15 ± 0.03	93.44 ± 0.19	91.61 ± 0.63	0.27 ± 0.01
5%	6.16 ± 0.02	93.12 ± 0.48	91.16 ± 0.51	0.27 ± 0.01
10%	6.15 ± 0.02	93.02 ± 0.43	91.06 ± 0.28	0.28 ± 0.02
15%	6.14 ± 0.03	92.87 ± 0.26	90.96 ± 0.49	0.30 ± 0.02

n = 6 for emulsion pH, emulsion stability and cooking yield

n = 18 for shear force value

Results and Discussion

Mean values of emulsion pH and stability, cooking yield and shear force value of chicken loaves are presented in Table 1. Extension with Bengal gram had no significant effect on emulsion pH and stability. A non-significant decline in emulsion stability due to this extender may be attributed to substantial quantity of starch in Bengal gram (Gopalan *et al.*, 1977). Its exten-

Table 2. Effect on the sensory quality of chicken loaves extended with Bengal gram (Mean \pm SE)

Level of Bengal gram	General appearance	Flavour	Juiciness	Texture	Overall acceptability
0%	6.33 ± 0.18	6.55 ^a ± 0.12	6.44 ± 0.14	6.39 ± 0.14	6.61 ^{ab} ± 0.11
5%	6.39 ± 0.14	6.33 ^{ab} ± 0.16	6.28 ± 0.13	6.44 ± 0.18	6.77 ^a ± 0.13
10%	6.46 ± 0.14	6.08 ^b ± 0.18	6.17 ± 0.12	6.55 ± 0.12	6.20 ^{bc} ± 0.13
15%	6.45 ± 0.18	6.03 ^b ± 0.18	6.11 ± 0.18	6.61 ± 0.12	6.05 ^c ± 0.17

Means with different superscripts in each column differ significantly ($P \leq 0.05$). $n=18$ for each treatment.

sion in paste form leaves comparatively less scope for further water binding.

Mean sensory scores of chicken loaves are given in Table 2. There was a marginal increase in general appearance and texture scores of chicken loaves due to increased extension with Bengal gram. Improvement in texture may be attributed to addition of protein and starches of vegetable origin (Price and Schweigert, 1971). There was no significant difference in the flavour scores due to extension with Bengal gram upto 5% level whereas significant decrease ($P \leq 0.05$) was observed at higher levels. These results corroborate with the findings of Sharma *et al.*, (1988) and Padda *et al.* (1989). Flavour of chicken loaves declined mainly due to moderately desirable flavour of Bengal gram at higher levels of lean meat extension. There was an insignificant decrease in juiciness of loaves as a result of extension with Bengal gram. This result is an agreement with the findings of Padda *et al.* (1988) in pork koftas and may be attributed to less water retention in the product during cooking. Overall palatability in chicken loaves did not decrease significantly at 5 and 10% levels of Bengal gram as compared to control whereas it decreased significantly at 15% level of Bengal gram. Padda *et al.* (1989) also reported similar results in goat meat balls. Moderately lower overall palatability of chicken loaves at higher levels of extension with Bengal gram may be a reflection of other sensory attributes namely flavour and juiciness.

The proximate composition of chicken loaves is shown in Table 3. Moisture content of chicken loaves declined marginally due to extension

with Bengal gram and may be due to less moisture content ($32.94 \pm 6.58\%$) in Bengal gram paste. Protein content of chicken loaves did not vary significantly. There was a non-significant decline in fat content of chicken loaves due to extension with Bengal gram. These observations are in conformity with the findings of Sharma *et al.* (1988) and Padda *et al.* (1989) and might be due to dilution effect caused by increased extension with Bengal gram which is practically defatted.

Table 3. Effect on proximate composition of chicken loaves extended with Bengal gram (Mean \pm SE)

Level of Bengal gram	Moisture (%)	Protein (%)	Fat (%)
0%	62.55 ± 0.26	16.41 ± 0.12	12.86 ± 0.17
5%	62.24 ± 0.33	16.12 ± 0.40	12.60 ± 0.21
10%	61.89 ± 0.28	15.98 ± 0.45	12.49 ± 0.32
15%	61.71 ± 0.25	15.69 ± 0.20	12.42 ± 0.24

$n=6$ for each treatment.

These findings indicate that chicken loaves of very good acceptability and nutritive value could be produced at a relatively low cost extending lean meat with Bengal gram upto 15% level in the formulation.

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Modified Lecithins to Tailor Specific Requirements

by

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A natural constituent of both plant and animal products, Lecithin is derived commercially from soyabeans. It also occurs in high concentrations in egg yolk, and is a principal component of the natural emulsifier system in milk and buttermilk¹. The surface active and emulsifying properties of lecithin give it a commercial value and being a natural product, it has an added advantage in today's market demanding non-chemical additives.

The world consumption of lecithin is estimated at 100,000 tons per annum. In western Europe 30,000 tons are used, of which more than half is applied as modified lecithins.

The term lecithin is derived from Greek word for egg yolk 'lekithos.' It was first isolated from egg yolk in 1850 by Gobley. Earlier believed to be an expensive raw material for food industry, its extraction from vegetable source has altered this view. The cost of lecithin is today determined by the type of extraction process used and the degree of purification desired.

Commercial lecithin is predominantly obtained from soyabean oil. The specific phospholipid formerly called as lecithin is now referred to as phosphatidyl choline. Lecithin consists not only of a mixture of phospholipids, but also triglycerides, some pigments, sterol, sterol glycosides, esters, tocopherols and carbohydrates²⁻⁷. Besides phosphatidyl choline, the other phospholipids commonly encountered in lecithin are phosphatidyl ethanolamine, phosphatidyl inositol, phosphatidic acid and phosphatidyl serine. The ratio of these phospholipids is more important for the functionality. For instance, high phosphatidyl choline favours oil in water emulsion. Processing factors can, either deliberately or unintentionally affect the performance of lecithin as an emulsifier⁸.

Methods to extract lecithin from soyabean oil are well documented^{9,10}. However, six different grades of lecithin are available depending on colour and viscosity. Lecithins could be natural (unbleached), bleached lecithin or

Table 1 : Specifications for Commercial Lecithin

	Unbleached		Single Bleached		Double Bleached	
	Plastic	Fluid	Plastic	Fluid	Plastic	Fluid
Acetone insolubles (%)	65.0	62.0	65.0	62.0	65.0	62.0
Acetone solubles (%)	34.0	37.0	34.0	37.0	34.0	37.0
Moisture (%)	1.0	1.0	1.0	1.0	1.0	1.0
Phosphorus (%)	2.2	2.1	2.2	2.1	2.2	2.1
Nitrogen (%)	0.9	0.8	0.9	0.8	0.9	0.8
Ether insoluble matter (%)	0.2	0.2	0.2	0.2	0.2	0.2
Acid value	20.0	30.0	20.0	30.0	20.0	30.0
Colour						
Yellow	30	30	20	20	10	10
Red	2.5	2.5	1.5	1.5	0.5	0.5

double bleached lecithin. Specifications for commercial lecithins are as given in Table 1.

Functional Properties of Lecithins :

Commercial lecithins are widely used as multifunctional additives in a variety of food such as margarine, chocolate, instant powder products, confectionery, surface coatings etc^{11,12}. Some of the important functional properties of lecithin are as follows^{8,13}:

- promotes emulsification
- acts as releasing/parting agent - helps disperse flavours and colours
- modifies viscosity and improves product texture
- reduce stickiness
- has instantizing properties such as particle wetting and dispersing
- imparts stability to concentrated milk products against coagulation during sterilization
- acts as a flavour improver
- improves the functionality of monoglycerides and steroyl lactylates
- acts as a synergist with primary

antioxidants such as TBHQ

x) diet supplementing/nutrition - it is known for improving the neurochemical disorders

Mode of Action of Lecithin:

Lecithin has been reported to stabilize the fat emulsion by absorbing strongly at the triglyceride/water interphase often forming relatively thick liquid crystalline layers¹⁴. Such lamellar mesophase forms specifically at temperatures between 40 and 60°C. The swelling of the lamellar phase is limited to a content of 40% water. Impurities in lecithin such as lysolecithin disrupt the lamellar phase and hence care should be exercised to make lecithin free of such impurities¹⁴.

Phosphatidyl choline has oil in water emulsification promoting characteristics. Phosphatidyl ethanolamine and to a lesser extent phosphatidyl inositol have water in oil emulsifying property. For both types of emulsions, lecithin can be used provided other conditions such as pH, salt concentration, and oil to water ratio is chosen carefully. Water hardness is also important since phosphatidyl ethanolamine and phosphatidic acid can be flocculated by a high concentration of

calcium and magnesium ions are therefore inactivated as emulsifiers¹⁵.

Modification of Lecithins:

The need for production of modified lecithins has been felt because of the need for lecithins with specific properties such as emulsifiers and wetting agents. One principle of modifying lecithin as an emulsifying agent often consists of removal or transformation of the phosphatidyl ethanolamine fraction, by which the calcium sensitivity is reduced and the polarity becomes stronger. A second principle is the adaptation of the physical state by introducing the phospholipids into carriers such as oil, solvent, proteins or by deoiling the phospholipids. This is done for convenience in industrial use for effective performance by physical means, chemical means or by enzymic modification¹⁵.

Physical Means of Modification:

Alcohol fractionation: The principle of this process is based on the difference in the solubility of phospholipids in alcohols. Liquid-liquid extraction is used to obtain both alcohol soluble phosphatidyl choline enriched fraction and alcohol insoluble phosphatidyl ethanolamine fraction. A multitude of parameters such as polarity of the alcohol, concentration, lecithin/alcohol ratio, temperature and extraction time permit the production of fractions with varying PC/PE ratio of 1.2:1 of natural lecithin. Extraction with alcohol can yield fractions with PC/PE ratio upon 8:1¹⁵. Ethanol is generally used. The alcohol soluble fraction is more hydrophilic and alcohol insoluble fraction is more lipophilic¹⁶. Fractionation gives more uniform and characteristic surfactant properties.

The surfactant behaviour is a composite of the properties and include other polar lipids, sterols and sterolglycosides. Since alcohol fractionation can change phospholipid composition, its emulsifying activity is greater than that of acetone fractionated lecithin i.e. oil free lecithin.

Alcohol soluble fraction has increased emulsifying activity for oil in water emulsion, while the alcohol insoluble fraction favours the water in oil emulsion. An emulsifying and antispattering agent for use in margarine is prepared by fractionation of

soya lecithin with alcohol, partial hydrolysis of the insoluble fraction and recombination of this partially hydrolysed fraction with alcohol soluble is done¹⁵.

Acetone extraction: As phospholipids are not soluble in acetone, this solvent is used for oil removal. Powdered and granulated phospholipid blends with 95 - 98% acetone insolubles are obtained¹⁵. Most of the free fatty acids and triglycerides can be separated from crude lecithin by acetone fractionation to give oil free lecithin powders. The product is dry, tan coloured, waxy solid that can be made to special particle sizes and have excellent free flowing particles.

Oil free lecithins cost ten times more than regular lecithin. Since it is oil free, acetone fractionated lecithin has greater hydrophilicity and increased emulsifying activity. Food stuffs such as baked goods, beer, wine, meat products have long been produced using microbiological controlled fermentation processes. The monitoring of the fermentation process can be done in other ways, by use of proper starter culture. To speed up the action of starter cultures and to give more cost effective and efficient production, use of deoiled lecithin is recommended. It is important to ensure even distribution of deoiled lecithin powder in the nutrient medium and conduct the thermal treatment at 110-120°C for 30 minutes¹⁷.

Spray cooling with synthetic emulsifier: Combination of lecithins with monoglycerides or diglycerides can be an effective emulsifier. By spray cooling 30% lecithin and 70% monoglycerides or diglycerides, flakes or powdered products can be obtained¹⁵. Commercial lecithin can be blended with other compounds. These include oil, polysorbates, solvents and/or plasticizers. They are generally blended with dry or fluid lecithin. Deoiled lecithin may be combined with selective additives to improve handling and performance⁸. Lecithin enhances the solubility of monoglycerides in oil blend before heating.

Spray drying with proteins: Lecithin dried onto proteins as a carrier have the advantage that powdered products are obtained at relatively low cost. Using skimmed milk and whey, the lecithins are encapsulated by a thin film of casein which contributes to

good free flowing property. It is possible to produce lecithin vegetable protein blends with good free flowing properties as well¹³. A spray dried blend of sweeteners and lecithin has been designed as an ingredient for bakery and confectionery goods which can replace sugar or shortenings or egg solids or a portion of the flour depending on the formulation. This product is known to have a sweetness about 40% that of sucrose.

Chemical Means of Modification :

Lecithin are chemically modified by hydrogenation, ethoxylation, halogenation, sulphonation, acetylation, or ozonisation, but it has not been successfully ethoxylated.

Hydroxylation : High concentration of hydrogen peroxide in combination with acids especially lactic acid cause the introduction of hydroxyl groups in the unsaturated fatty acid chain. In addition, the amino group of the phosphatidyl ethanolamine is modified^{15, 18-19}. Acetic acid can also be used in place of lactic acid. An alternate method of preparation of hydroxylated lecithin is the use of hydrogen peroxide and sodium hydroxide²⁰. The colour of the products is extremely light but the flavour tends to be soapy.

Hydroxylated lecithins have pronounced hydrophilic character that enables the product to be dispersed easily in cold water. Such mildly modified lecithins have a high rate of functionalities in water based system¹⁸.

Hydrogenation : Lecithin can be hydrogenated by the usual means to form a white stear in like solid. Hydrogenated lecithins has not been investigated thoroughly. For technical purposes, lecithin can be hydrogenated in solution in mineral oil or saturated fatty acid and then recovered by acetone treatment. Nickel is used as a catalyst^{21,33}.

Hydrogenated soya lecithins are used as lubricating oil additives. Phosphatides useful in food additives, cosmetics and medicines have been reformed by hydrogenation of fat or oil containing phospholipids in presence of water²².

Acetylation : Treatment with acetic anhydride acetylates the amino group of the phosphatidyl ethanolamino. By varying reaction conditions such as

temperature, reaction time and acetic anhydride concentration, the process can be performed with lecithin sludge and dried lecithin, achieving varying degrees of acetylation. The principle of the process is the blocking of the zwitterionic group of the phosphatidyl ethanolamine, thus improving the oil in water emulsifying property^{15,23}.

The extent of acetylation and the pH is important for applications of lecithins. For instance, a heat resistant liquid lecithin prepared by acetylating lecithin to less than 1.2 mg N/g and adjusted to pH 7.4 gives absolutely clean pancake after baking process, while pans coated with release agents containing acetylated lecithin to 1.5 mg N/g and adjusted to pH 6.5 gives a dark and unclean product¹⁷.

Hydration : Phosphatidyl choline has higher affinity for water than phosphatidyl ethanolamine or phosphatidyl serine. Cholesterol increases hydration of phosphatidyl choline. When cholesterol is complexed with phospholipid, an increase in the number of double bonds in the hydrocarbon chain of phosphatidyl choline results which enhances the hydration of the chain²⁴.

Halogenation : The unsaturated fatty acid groups in soya lecithin can be chlorinated and brominated readily to form the corresponding halogenated phosphatides. These derivatives resemble ordinary lecithin in physical and chemical properties²¹.

Halogenated lecithins do not find much applications. Perhaps it has applications as high pressure lubricant additive.

Polyoxyethylene derivatives : This can be prepared by the action of ethylene oxide^{21,25}.

Coacervate formation : Lecithin forms coacervates with many substances including carbohydrates, protein, alkaloids, salts, dyes, enzymes etc. A coacervate of sodium chloride and lecithin is ether soluble. Water soluble certified dyes may be made oil soluble by coacervating them with soya lecithin²¹. Organometallis lecithinates have been prepared for use in paints¹⁶.

Addition compounds of lecithin : Some of the phosphatides of soya lecithin such as the phosphatidyl amino esters form addition compounds with salts of heavy metals such as cadmium chloride and platinic mercuric chloride²¹.

Hydrolysis : Lecithin may be saponified readily by boiling with aqueous or alcoholic solution of bases or hydrolyzed by boiling with aqueous solution of strong acids. In saponification process, soaps are formed with liberation of various amino groups and carbohydrates. Further decomposition into glycerol, inositol and phosphoric acid may follow prolonged heating²⁶. Acid hydrolysis produces free fatty acids and free forms of the same hydrolytic products. Lecithins with an undesirable dark colour is often obtained¹⁵. Enzymic hydrolysis using specific phospholipases is therefore preferred.

The functions of lecithins is margarines is to stabilize the water in oil emulsion and also prevent spattering during frying¹⁵. In high salt margarine the phospholipid composition of high quality natural lecithin acts as an effective antispattering agent. In low salt or no salt margarines, however, the calcium and magnesium ions of the water and the milk protein inactivate some phospholipids such as phosphatidyl ethanolamine by flocculation. In these types of margarines, less calcium sensitive lecithins are required. The solution has been found in the incorporation of fractions enriched in choline lecithin and partially enzymatic hydrolysed lecithin¹⁵.

Sulphonation : Lecithin can be sulphonated only with difficulty by the usual means because the sulphonating agents used are generally strong dehydrants like sulphuric acid and chlorosulphuric acid. In the presence of aldehydes, ketones or phenols, however, lecithin may be easily converted by treatment with sulphur dioxide into sulphonated derivatives. The aldehyde, ketone or phenol becomes an integral part of the phosphatide molecule^{21, 27}.

Sulphonated products of lecithin find application in textile and tanning industry. The sulphonated phosphatides form clear solution in water and are resistant to precipitation by acids and salts²¹.

Enzymic Means of Modification :

Lecithin may also be hydrolysed by lipases. It is claimed that not more than four or more different lipases are necessary to disrupt the various esters, ether or phosphoryl linkage. On laboratory scale several types of phospholipases are used. On an industrial scale phospholipase A₂ is the most attrac-

tive. This enzyme specifically hydrolyses the fatty acids at the beta position of phospholipid and results in the lyso form of the lecithin.

Each type of phospholipid has its own reaction speed under given conditions. Lysolecithin has enhanced solubility in water and greater emulsifying activity for the formation of oil in water emulsion¹⁵.

Three lecithin products suitable for a variety of applications were recently introduced. One is hydrolysed lecithin powder with enriched content of lipophospholipids that is said to have health benefits. It is suitable for bakery products and for stabilizing dietetic and food emulsion. For dietetic industry, a lecithin granule with an enriched content of phosphatidyl choline for direct consumption has been developed. Due to special granulation process, it is possible to combine the products with flavours, vitamins, fibres and proteins. The third new development is free flowing lecithin for the production of sweet wafer cones for ice creams. With this products the wafers are easily released from the wafer iron. Since less residue is left on iron, it is easier to clean and it does not require frequent cleaning.

Miscellaneous Methods of Modification :

Lecithin— protein complex : An emulsifying agent has been prepared by complexing lecithin with gluten or globin for use in food, pharmaceuticals and cosmetics. Many proteins are used by food processors for functional attributes rather than for nutritional fortification. Insolubility of these proteins is a major limitation in their use in foods. Lecithin complex improves the functional properties of gluten and globin proteins^{28,29}.

Heating : The effectiveness of lecithin as an emulsifier in water in oil emulsion is increased by heating lecithin. Heating may result in some weight loss, complete loss of noncholine phosphatides, decreased phosphatidyl choline content, changes in fatty acid composition and formation of triglycerides and other substances³⁰.

Combination of Lecithin with Carrageenan : The emulsifying activity of soya lecithin is markedly enhanced by combining it with carrageenan. Application of such emulsifiers include both food and non-food applications³¹.

The multifunctional properties and its natural status makes commercial lecithin an ideal food ingredient. Addition of lecithin could reduce the quantum of chemical antioxidant, rendering the product safe and economical. Lecithins with tailor made performance need to be developed, and this could be achieved by modification.

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Lactic Acid Fermentation Of Cabbage For Pickling

by

Neelima Garg, D.K. Tandon and S.K. Kalra

Central Institute of Horticulture for Northern Plains, Lucknow - 226002

Introduction :

Lactic acid fermentation is one of the oldest method of preserving vegetables. Apart from contributing certain desirable physical and flavour characteristics, it also prolongs the availability and processing period of the product at a relatively low cost. In U.S.A. and other European countries, cabbage is grown largely for making pickle through lactic acid fermentation though other crops, like cucumber, green olive, onion etc. are also used for pickling in substantial amounts (2,3,4,6). In some parts of India, carrot is naturally fermented to produce kanji. However, cabbage pickling is uncommon in our country. Therefore, a methodology was standardised for the production of cabbage pickle, commonly known as sauerkraut, through lactic acid fermentation.

Materials and Methods :

Fully mature sound heads of cabbage were trimmed to remove the outer green torn and damaged leaves. The core was removed and the cabbage was shredded finely (approximately 0.2cm thick). Powdered salt @2.5 g per 100 g cabbage was spread uniformly through-out the mass of shredded cabbage. The shredded cabbage was then packed tightly into the glass jars. The surface of cabbage was covered with a plastic sheet (bigger than the mouth of jar) with the edges dropping out the sides of the container. Enough water was added over the sheets so that the cabbage shreds slides down into the brine until the surface of uppermost shred was covered with the brine. The changes in microflora were observed till the fermentation was complete as evidenced by no further increase in acidity. The final products was stored in refrigerator and the shelf life was studied.

Total aerobic microflora, G-ve bacteria, yeasts and moulds were observed by plate count method (1) in fresh and fermented cabbage. Lactic acid bacteria were isolated by selective medium plating technique. Salt and total acidity were determined by titrimetric method (1,5).

Results and Discussion :

Fermentation of cabbage took about 20 days for its completion. The acidity increased with the prolongation of fermenta-

tion period until 15 days with a maximum acidity of 1.25% lactic acid (Fig. 1).

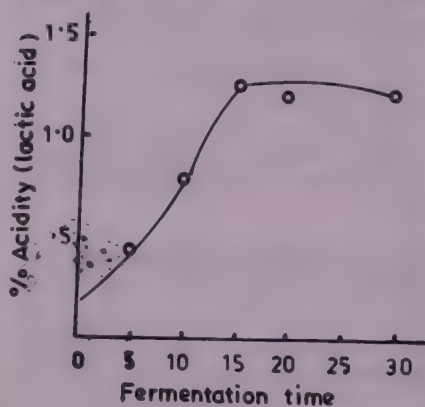


Fig.1 Changes in acidity during cabbage fermentation.

Thereafter, it remained almost constant and the fermentation process was considered to be complete. Many types of G-ve, some G+ve bacteria including *Lactobacillus*, some moulds and yeast are present on the outer leaves of cabbage (4). Microbial analysis of cabbage at various stages of sauerkraut preparation indicated that the initial population of G-ve bacteria was 3.4×10^5 cells per g cabbage and it decreased significantly as the fermentation progressed (Fig 2.). The counts of lactic acid bacteria were as low as 1.5×10^1 cells per g cabbage initially, which increased upto 6.5×10^6 cells per g cabbage after 15 days of fermentation. The reason being that addition of salt to shredded cabbage extracted sugars and other nutrients from the cabbage and provided favourable growth medium for *Lactobacillus* as was reported by Pederson and Albury (4). These lactic acid bacteria, on utilization of extracted sugars, produced lactic acid which in turn dropped the pH of the medium. That is why increase in acidity coincided with the increase in population of lactic acid bacteria. Low pH conditions in turn retarded the growth of undesirable G-ve bacteria, yeast and moulds because of their inability to survive in acidity environment. After the complete utilization of sugars, constant acidity was attained and the fermented was considered complete.

The fermented cabbage-sauerkraut, could be stored in refrigerator for 3 months without any treatment or addition of preservatives. In United States, pasteurization or canning is done to improve the shelf life of cabbage sauerkraut. The prepared cabbage sauerkraut when put to organoleptic

test by semiskilled judges, was found acceptable by 80%, however, 20% of the judges evaluated it as more acidic. This sauerkraut when sweetened by adding 15% of 70° B sugar solution, was acceptable to all judges.

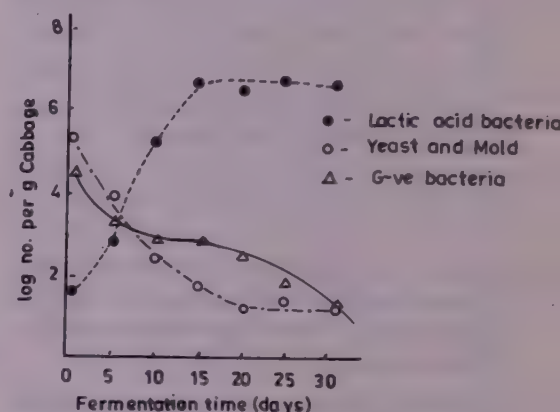


Fig.2 Changes in microflora during cabbage fermentation

Thus, it may be stated that cabbage pickle sauerkraut could be prepared under Indian conditions through fermentation, without much optimization. The process can be easily taken up and such recipes can be very popular at home or small scale industry level.

Acknowledgement :

The authors are thankful to Director, CIHNP for providing necessary facilities for conducting this study.

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Assessment Of Pesticide Residues In Milk

by

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Pesticides are commonly used in agriculture to produce more food of high quality. This field is governable by legislation and related administration to ensure complete protection and consumer's health. The latter should be the absolute aim in increasing the agricultural production.

But the use of pesticides is also associated with the residue problem. Although pesticides eradicate the pests yet tend to pollute the environment of man and animal. The lipophilic organochlorine pesticides accumulate during their passage through the food chain and their traces in fat base are likely to be found in milk.

Milk is consumed as main food by the infants and as dietary supplement by children and adults throughout the world. Usually, milk is obtained from cows and buffaloes. But milk derived from goat, sheep and camel is also consumed in some countries. Milk proteins are rich sources of all essential amino acids. Milk also contains minerals like calcium, phosphorus, iron etc. and vitamins which are essential for the growth of children. Thus, milk may be referred to as perfect food. However, milk is liable to get contami-

nated with pesticide residues which are harmful to its consumers.

To assess the contamination of pesticide residues in milk available in local markets of Nagpur, the present study was undertaken.

Materials and Methods

Twenty samples of fresh fluid milk were procured from the local markets of Nagpur. The A.O.A.C. methodology was adopted for analysis of the samples using thin layer chromatographic technique.

Results and Discussion

Out of 20 samples of milk analysed, 5 samples showed the presence of B.H.C. (Benzene Hexa Chloride).

whereas one sample showed the presence of both B.H.C. and D.D.T. The range of B.H.C. in the contaminated samples was 1.01 p.p.m. to 0.08 p.p.m. on fat basis, while D.D.T. was found 0.98 p.p.m. and 1.02 p.p.m. in two samples of milk on fat basis.

The data in the Table reveals that 10% of the samples of milk were contaminated with D.D.T. and 25% with B.H.C. Milk is a major source of nutrition to young ones, old and disabled persons who are needed to consume it in much quantity. Therefore, the milk containing pesticide residues beyond tolerance limit will prove harmful rather than beneficial to them. The maximum limit of D.D.T. and B.H.C. prescribed under the Prevention of Food Adulteration Act are 1.25 p.p.m. and 0.2 p.p.m. respectively on fat basis in milk. Thus, the samples of milk collected from Nagpur markets were well within the prescribed limit of D.D.T. and B.H.C. residues.

Table

S.No.	Commodity	D.D.T. (Mg./Kg.)	B.H.C. (Mg./Kg.)
1.	Milk (Fluid)	Nil	0.05
2.	Milk (Fluid)	0.98	—
3.	Milk (Fluid)	Nil	0.01
4.	Milk (Fluid)	Nil	0.08
5.	Milk (Fluid)	Nil	0.03
6.	Milk (Fluid)	1.02	0.01
7. to 20	Milk (Fluid)	Nil	Nil

Reference :

1. Association of Official Analytical Chemists Vol.I. 15th Edition, P. 278. 1990.

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Thermal Expansion of Some Liquid Foods

by

Radha Charan¹ Arup Datta² Sanjay Mathur²

Introduction

Each year large amount of milk and fruit juices are processed in the food processing plants. These are required to be handled quickly and carefully to avoid spoilage and loss of quality. For processing of foods the properties must be known for their efficient processing. Thermal expansion of liquid foods is one of the important properties which is required in designing of heating and cooling equipments, capacity design of storage silos etc. Liquid foods change in volume with the rise in temperature.

Change in the length of an object is known as linear expansion which is proportional to the original length and change in temperature affecting the object. The relationship between the coefficient of linear expansion and length of the object is given by

$$L_f = L_i (1 + \alpha \Delta t)$$

Where L_i and L_f are initial and final lengths of the object Δt is change in temperature affecting the expansion

The coefficient of area expansion, β is twice the coefficient of linear expansion ($\beta = 2\alpha$). The liquids change in volume with the rise in temperature. Volumetric expansion is actually linear expansion through three dimensions. Like coefficient of area expansion, coefficient of volumetric expansion is also thrice the coefficient of linear expansion. The thermal expansion of the heated portion of a material results in density difference in the material. The physical property denoting this effect is the coefficient of thermal expansion. If a substance has an initial volume of V_i and is heated so that its volume increases to V_f while its temperature increases from T_1 to T_2 , then the average coefficient of thermal expansion τ is defined by

$$V_f = V_i (1 + \tau \Delta t)$$

τ is coefficient of volume expansion,
($\tau = 3\alpha$) $\Delta t = T_2 - T_1$

The significance of the coefficient of

thermal expansion is in the change of density of the material affecting the heat transfer process. Although this density effect is not too significant for solids, in the case of liquids and gases it becomes quite significant. As the liquids do not have a shape of their own, the expansion of the container is also taken into consideration.

Toned milk, cow milk, orange juice and sugarcane juices were selected for the purpose of the study. Toned milk and cow milk was obtained from the local distribution centre of Rajasthan Cooperative Dairy Federation Ltd. and private dairy respectively. The fresh juices used in the study were procured from juice centre. The total solids in juices milk were determined as Jain (1993).

The set up used in the study consisted of a rectangular shaped insulated container, electrical motor driven stirrer, a thermostatically controlled electric water heater (3kW), a test tube (60ml), and a graduated glass tube (5ml) with stand. In the experiment the test tube was filled with the sample of known volume. A rubber cork, containing graduated glass tube in the centre, was put and pressed on the test tube till certain amount of liquid was raised in the glass tube column. No air bubble was allowed to remain in the test tube. Now the sample was placed in the water bath maintained at constant temperature. The temperature of water bath was gradually raised and the change in volume of sample was recorded. Each successive value of tem-

perature and volume with the corresponding previous value of temperature and volume was used to get the apparent coefficient of thermal expansion as :

$$Ca = \frac{(V_2 - V_1)}{V_1 (T_2 - T_1)}$$

The coefficient of thermal expansion of glass ($9 \times 10^{-6}/^\circ\text{C}$) was then added to get the real coefficient of thermal expansion of liquid foods. Each experiment was replicated thrice.

Results and Discussions

The average coefficient of thermal expansions at various concentrations of toned milk, cow milk, sugarcane juice and orange juice are given in Fig. 1 to 4 respectively. It can be seen from Fig. 1 and 2 that the average coefficient of thermal expansion of toned milk and cow milk decreased from 3.842×10^{-4} to $2.144 \times 10^{-4}/^\circ\text{C}$ and from 4.286×10^{-4} to $2.059 \times 10^{-4}/^\circ\text{C}$ when total solids increased from 15 to 59.7 % and from 16.68 to 31.45% respectively.

Similarly the average coefficient of thermal expansion of sugarcane juice and orange juice varied from 3.316×10^{-4} to $4.0 \times 10^{-4}/^\circ\text{C}$ and from 2.775×10^{-4} to $5.37 \times 10^{-4}/^\circ\text{C}$ when total solids increased from 10 to 30% and from 7.5 to 22.5% respectively (Fig. 3 and 4).

It is also inferred from Fig. 1 and 2 that the decrease in the average coefficient of thermal expansion of toned milk and cow

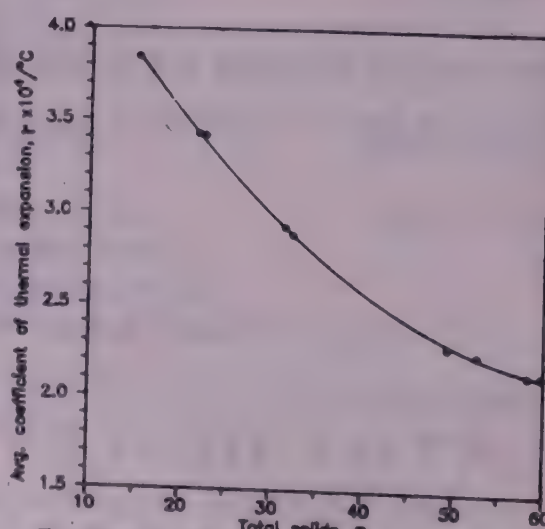


Fig.1 Effect of total solids on average coefficient of thermal expansion of toned milk

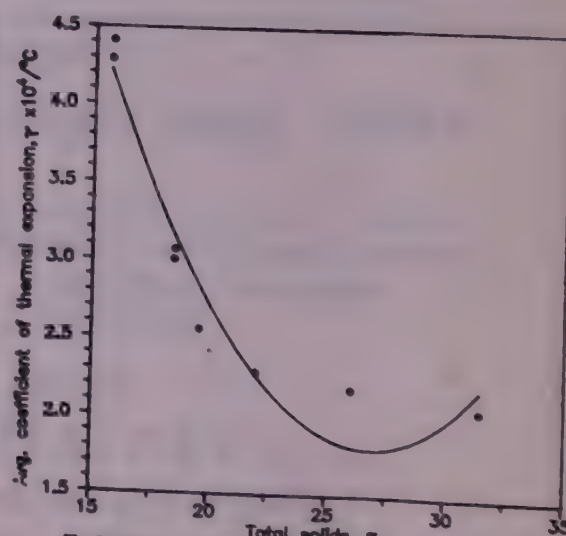


Fig.2 Effect of total solids on average coefficient of thermal expansion of cow milk

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$$(r^2 = 1.00)$$

Cow milk:

$$Y = 15.701 - 1.034 X + 0.019 X^2$$

$$(r^2 = 0.95)$$

The reason of decrease in coefficient of thermal expansion with increase in concentrations of total solids is due to the difference in the expansion of liquids and solids in the food materials. The expansion of water is comparatively more than the expansion of solids present in the liquid foods. Therefore, when the solids increase, the thermal expansion of the liquid foods decreases.

The variation in thermal expansion of sugarcane juice is also found of the order of second polynomial but increase in expansion upto $4 \times 10^{-4}/^{\circ}\text{C}$ was observed when the total solids increased from 10 to 30% and thereafter it decreases when the solids increased upto 50% (Fig. 3). The relationship of its thermal expansion coefficient with total solids is found as follows.

$$Y = 2.792 + 0.076 X - 0.0012 X^2$$

$$(r^2 = 0.86)$$

Similarly the variation in coefficient of thermal expansion of orange juices is found

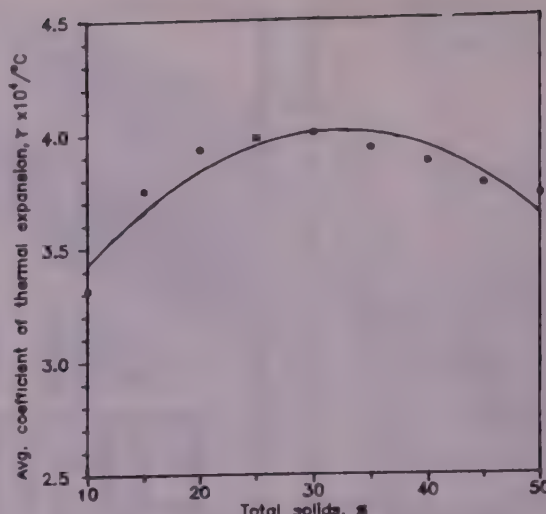


Fig.3 Effect of total solids on average coefficient of thermal expansion of sugarcane juice

of the order of third polynomial. It is inferred from the Fig. 4 that the coefficient decreases in the beginning upto 7.5% solids concentration and then increases upto $5.37 \times 10^{-4}/^{\circ}\text{C}$ when the total solids increased upto 22.5%. The relationship of the average coefficient of thermal expansion of orange juice with the total solids is found as follows

$$Y = 5.136 - 0.682 X + 0.06 X^2 - 0.0013 X^3$$

$$(r^2 = 0.99)$$

where Y is volumetric coefficient of thermal expansion, $^{\circ}\text{C}$

X is concentration of total solids, %

It is expected that this type of variation in

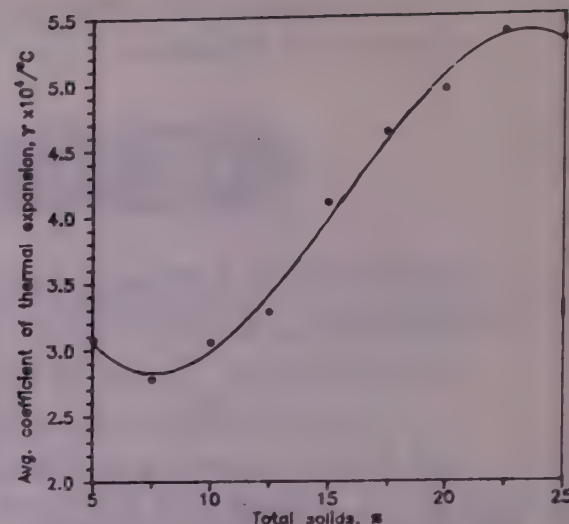


Fig.4 Effect of total solids on average coefficient of thermal expansion of orange juice

the average coefficient of thermal expansion of the sugar cane juice and orange juice is because of the compositional variation.

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Annatto - A Natural Colorant

by

Harish Kumar Sharma

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Abstract

Annatto pigments have been used for coloring both industrial and home made foods. The important properties like different forms of application, good stability suggest a promising increase in the view of the possibility of total ban on synthetic colors in near future.

Introduction

Among the organoleptic attributes of food, color is an important factor influencing consumer acceptance of food. The demand of food products containing natural food ingredients is increasing day by day due to consumer awareness followed by change in legislation. Several synthetic colors have been deleted from the 'permitted' list and are likely to be banned in future due to their suspected carcinogenic effect. Several countries have banned all artificial food colors. In Switzerland, only natural pigments are admitted even in the feed preparation for laying hens to produce eggs with more yellow yolks. Hence the 'natural' pigments are now in vogue for food applications.

Natural coloring matters of plant origin include carotenoids and anthocyanins. Among the carotenoids, annatto has tremendous potential in this respect.

Annatto extracts have been used for a considerable time, particularly for coloring both industrial and home made foods. Commercial annatto color, also known as Orlean or Rocou, is obtained by extraction of the pigments of the pericarp of the fruits of *Bixa Orellana* L. named after Francisco de Orellana, the conquistador, who first explored the Amazon river in 1541. This large shrub, 2-5 m high, native to tropical America, is now grown in most of tropical countries viz Bolivia, Brazil, Ceylon, Dominican Republic, Ecuador, Guyana, India, Jamaica, Mexico, Peru and Surinam. The crop is produced on a lesser scale in Africa, in Angola, Kenya, Nigeria, Tanzania and in the Pacific in the Philippines and Hawaii (Ingram & Francis, 1969). The

fruit consists of a burr like pod similar to a sweet chestnut, containing between 10 and 50 seeds about the size of grape seeds, covered with a thin layer of soft, slightly vermilion pulp.

The major carotenoid of pericarp cis-bixin, the mono-methyl ester of dicarboxylic acid cis-norbixin (McKeown, 1961), is orange in color and is insoluble in vegetable oil. On heating, it is readily converted into the more stable isomer trans-bixin, which is red and soluble in oil, together with degradation products, notably a yellow C17 pigment described by various authors (Iversen & Lan, 1953; McKeown & Mark, 1962; McKeown, 1963, 1965). The cis bixin is required to be in solution before the C17 re-arrangement can occur.

The structure of major annatto carotenoid is shown in Fig.1.

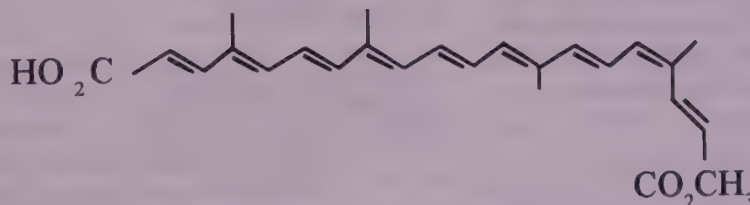


Fig.1. Structure of major carotenoid (cis-bixin)

Types & Methods of Annatto Extracts :

1) Water Soluble Annatto

- From seed : The pericarp of the annatto seed is extracted by agitation in alkali at temperature not more than 70°C to give an aqueous solution of Na or K salts of norbixin, probably in the cis and trans forms.
- From solvent extracted bixin : Bixin derived from solvent extraction of the pericarp by one or more stages, followed by removal of solvent, is hydrolysed with aqueous alkali to yield the sodium or potassium salts of norbixin (FAO/WHO, 1976).

2) Oil Soluble Bixin

Annatto seeds, immersed in veg-

etable oil at a temperature not exceeding 70°C, are mechanically abraded to remove the pericarp from the waste seed by a process known as raspelling. The slurry of the pigment in oil is heated under vacuum at a temperature not more than 130°C. The solution is filtered to remove insoluble materials. The major carotenoids include trans-bixin, a yellow thermal degradation products and cis bixin (FAO/WHO, 1976).

3) Suspension in Oil

There are three important methods :

- The extract of the pericarp in edible oil after raspelling is centrifuged and the finer particles blended with the oil to give a suspension in oil.
- The annatto pigment is extracted into a suitable solvent such as ace-

tone. The extract is being washed with hexane, or some other solvent, in which the pigment is virtually insoluble, removing unwanted impurities and odours. Milling in the edible oils to a particle size of about 10µ is then carried out to yield a microcrystalline suspension in oil. The solvents include acetone, dichloromethane, dichloroethane, ethanol, light petroleum and propane-2-ol.

- Extraction using food grade ingredients such as mono and di glycerides, free fatty acids or propylene glycol is also practised.

Extraction of Annatto :

Kocher, (1958) extracted annatto seeds with alkaline propylene glycol which would yield the alkaline salt of cis and /or trans form of bixin. Dendy,

(1966a) reported an alkaline extraction method followed by acid treatment. A continuous counter extraction with water while submitting the seeds to intensive mechanical friction has been patented (Rozinkov *et al.*, 1972). In another method, seeds were steeped with water at pH > 7.5 at 6°C, followed by treatment with water at pH 4 (Tadamasa, 1974). The annatto seeds were also extracted with 0.1N alkali to dissolve the pigment in the form of sodium bixinate which was precipitated as bixin with HCl. The precipitate after washing and drying was treated with petroleum solvents to remove the oil soluble part. The residue was mixed with NaHCO₃, dissolved in water and filtered to give a stable coloring material free of flavour (Marcus, 1963). In his method, Habaj, (1969) used 3 to 5% NaOH to extract the pigments at 60 to 70°C for 60-70 min. Water extraction of coloring matter is easier when annatto seeds are treated with commercial pectinase for 18 hrs at 22-26°C. A seven fold increase in the yield of pigment is reported (Schultz, 1979).

Krishnamurthy & Giridhari, (1976) found that extraction with 0.2% Na₂CO₃ is superior than water, ethyl alcohol, benzene and butanol. Among the various extraction methods, such as organic solvents, aqueous sodium carbonate, NaOH and dislodging using abrasion in water, solvent extraction has been reported superior (Bhalkar & Dubash, 1983). The pigment extraction from annatto seeds by solvent extraction with ethyl acetate as solvent has also been reported (Srinivasula & Mahapatra, 1989).

Maria *et al.*, (1957) used the mixture of chloroform and ethanol for extraction of pigments. The seeds also have been extracted with chlorinated alkanes, ketones or alcohol and concentrated the extracts. The crude pigment was reextracted with petroleum ether. To this concentrated extract, fatty oil is added (Friedrick, 1956). In a patent, seeds were treated with petroleum ether and subsequently pigments extracted in methanolic KOH (Plantex, 1972).

Normal commercial procedure is to soften the seeds with steam and extract the pigments with propylene glycol containing potassium hydroxide. An oil soluble form can be produced by treating steam softened seeds with a solvent such as ethanol, a chlorinated

hydrocarbon or a vegetable oil. Burnett & Esposy, (1958) reported the use of vegetable oil with or without heating as an extractant for coloring matter from seeds. Pigments has been isolated from seeds using agitation in a spouted bed holding 50 kg of seeds (Guimares *et al.*, 1989).

Supercritical carbon dioxide (SC-CO₂) has been used to extract annatto seeds with different pressures and temperatures. A higher yield of total pigments has been observed at extraction pressure more than 310 bar and 50°C (Chao *et al.*, 1991). The increase in efficiency of annatto pigment extraction during SC-CO₂ is reported to increase in the presence of an oil (Dengan *et al.*, 1991). Conditions for solvent-mediated fixed-bed extraction of pigments from annatto seeds have also been reported. Chloroform, acetone and diethyl ether are reported to be most efficient solvents in liquid phase and chloroform, acetone, ether and water are effective in vapour phase (Da Silva *et al.*, 1994).

Chemistry and Analysis :

Following major carotenoids have been reported from extracts (Preston & Rickard, 1980) :

Oil soluble bixin

Suspension of bixin in oil

Solvent extracted bixin

Water soluble extracts

a) Aqueous alkali extract of seed

b) Hydrolysis in aqueous alkali of solvent-extracted bixin

C17 thermal degradation product trans-bixin

Cis bixin

cis-bixin + some trans-bixin

cis-bixin + some trans-bixin

cis- & trans- norbixin

The number and concentration of the minor constituents present may be due to the extraction method, the temperature, the heating period, the origin of seed & the shelf life of the products. McKeown, (1961) isolated seven minor components in a chloroform extract of *Bixa orellana* seeds.

McKeown & Mark, (1962) reported that bixin and its isomers have maxima at about 500 nm & 470 nm in chloroform, whereas the yellow degradation pigments show maxima at about 404 nm & 428 nm (in chloroform) & do not absorb at 500 nm. Analysis of

the spectra at 500 nm & 404 nm can yield both the total pigments content and the bixin content of the extract (McKeown & Mark, 1962 ; Reith & Gielen, 1971).

It has been shown that bixin dissolved in vegetable oil or other solvents, undergoes a complex series of isomerization and degradations when heated to extraction temperature. A yellow pigment has been isolated from commercial annatto preparation (Iversen, & Lam, 1953). The structure of C₁₇ yellow pigment produced by thermal degradation of the C₂₅ bixin is shown in Fig.2 (McKeown, 1965).

The presence of diterpene, geranylgeraniol in the *B. Orellana* seeds together with bixin and other carotenoids (norbixin) which are responsible for coloring action of these seeds have been reported for the first time (Craveiro *et al.*, 1989).

Several TLC methods have been developed for the analysis of annatto pigments to replace the earlier chro-

matographic procedure (VanEsch *et al.*, 1959 ; McKeown, 1961). Francis (1965) described a modified rapid, sensitive method of measuring the quantity of bixin in annatto preparation. In this method glass plate coated with layer (250μ) of silica gel, containing approximately 12% gypsum as a binder and development in acetic acid/chloroform/acetone was used. The method is considered to be very rapid and accurate.

A modified method (Dendy, 1966) of measuring the quantity of bixin in annatto (*Bixa*) preparation is described

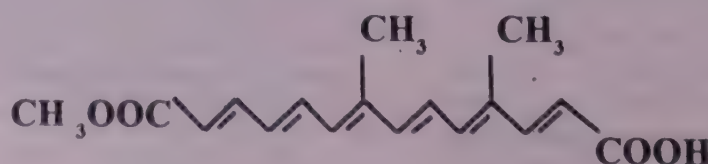


Fig. 2

TLC is used to separate the bixin which is then assayed spectrophotometrically. The method of separation is reported to be very rapid and no less accurate than a paper chromatographic method formerly used. These analytical procedures have been reported sufficiently sensitive to detect oil soluble bixin and water soluble annatto at 1mg level. All these methods require separate analysis for annatto and turmeric. The two colorants are often found together because addition of turmeric produces a yellower shade and also gives stability. A method in which the pigments in annatto can be separated and analyzed by HPLC using a Zorbax ODX column with a 58/42 mixture of water/tetrahydrofuran has been reported (Rouseff, 1988). A reverse phase HPLC utilizing photodiode array detection has been developed to enable the chromatographic and spectroscopic characterization of principle coloring components of annatto (Scotter *et al.*, 1994). An improved method for simple detection of annatto pigment in foods (fish, eggs & chinese mushrooms pickled with soy sauce or vinegar and ice cream) by HPLC has been reported. The limit of detection and the recoveries of the pigment are reported to be 2.5 mg/Kg of food sample and 91.2-109% respectively (Sato *et al.*, 1991). A spectrophotometric method has also been evaluated for the analysis of annatto seeds (Carvalho *et al.*, 1993). A photoacoustic spectrometric method has also been developed for the qualitative and semiquantitative analysis of annatto and its content in commercial seasoning products via the intensity of absorption peak (Haas & Vinha, 1995). In a collaborative study, it is reported that the extraction of pigment (bixin) from annatto seeds is best suited from chloroform extraction for the analysis

point of view (Yabiku & Takahashi, 1992).

Stability of Annatto

The pigments of annatto are unstable to oxidation, as are all carotenoid compounds, but they are relatively unstable than the other carotenoid colorants used in food. Light has been proved to be the most destructive and 10% ascorbyl palmitate was an effective antioxidant. While the presence of free radicals or any promoter of such species in annatto extracts is to be avoided as it causes a rapid loss of color (Najar *et al.*, 1988), good thermal stability at temperature 175 & 185°C by extrusion cooking has also been reported (Berset & Marty, 1986). Heltiarachchy & Muffett, (1986) patented the use of inorganic polyvalent cations together with hydrocolloids containing carboxyl groups to produce stabilized colorant complexes with annatto. A process to use demineralized water or demineralized glucose syrup together with 0.5% ascorbic acid to prevent fading of annatto in a beverage (Ford & Miller, 1987) and the use of annatto together with clouding preparation containing beeswax and a natural gum to minimize fading of annatto in fruit squashes (Ford & Draisey, 1987) have been patented. A stable colorant made from bixin by addition of ethol, sucrose acetate, hexaneisobutyrate, coconut oil and gum arabic has been reported (Ikawa & Kagemoto, 1975). Stabilization of bixin with vaillin eugenol or vitamin E is also known (Mori *et al.*, 1976). It is also reported that color intensity will reduce in the presence of sulphur dioxide thus alternative preservative systems are recommended when using annatto as a color. The stability of annatto powder in different packages (aluminium laminated film, metallized film, nylon and polyethylene (PE) coextruded film and PE film) with different oxygen transmission rates has also

been studied. It is reported that the initial bixin level reduces during first 2-3 weeks in all packages but stabilizes thereafter except in PE film. The product packaged in PE bags shows a bixin degradation rate of 0.04% per day during the study (Carvalho *et al.*, 1993).

Prentice *et al.*, (1993) reported that the pigment stability to heat is related to the initial quantity of cis and trans-bixin and the method employed to obtain the extract. This bixin has been observed to be more stable at intermediate and higher water activities (Beatriz *et al.*, 1995).

Applications :

Since long, annatto has been used in foods, especially in dairy products. Existence in different application forms suggests the need to establish which application form is best suited for a given food system. Food products in which it is being/can be used include dairy products like butter, margarine, low fat spread, cheese, flavoured milk and icecream, flour and sugar confectionery like sponge cake, bread crumbs and biscuits. Annatto extracts, in the form of special application grades of norbixin, are widely used in the coloration of smoked herrings and mackerel. Norbixin extracts are often used in the manufacture of chicken dishes, snack foods and dry mixes.

In addition to food applications annatto is also used for dyeing of silk, in varnishes etc.

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natto pigments are metabolised by liver (Preston & Rickard, 1979). A temporary acceptable daily intake (ADI) of 1.25 mg/kg body weight for annatto extracts has been given (FAO/WHO, 1970 a,b).

Though applicability of annatto has been studied world over, unfortunately in India except few reports (Bhalkar & Dubash, 1983; Srinivasula & Mahapatra, 1989) hardly any data are available. The trends in ban on synthetic food colors have necessitated a deeper insight into the availability, process standardisation and market potential for this natural pigment especially under Indian conditions.

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Xanthan gum are produced by aerobic submerged fermentation and are identical to the polysaccharide formed by the bacterium *Xanthomonas campestris*. Selected Kelco xanthan gums are used in the overseas market for confectionery, dairy products like ice creams, sherbets, sour creams etc., desserts like puddings, mousses, etc. bakery goods, pie fillings, flavoured emulsions, beverages, frozen fruits, dry mixes, dietetic foods (as a partial replacement for starch), sauces, toppings etc. They are sold under the trade names of Kelzans (industrial grade) and Keltrols (food grade).

For your requirements, contact:

Burzin & Leons Agenturen Pvt. Ltd.
Readymoney Building No.1,
Sir Ratan Tata Marg
Bombay 400 034
Tel : 4944616, 4921255
Tel/Fax : 4930283

UNIVERSAL FOOD FLAVOURS

Universal Food Flavours, Bombay, are the pioneer manufacturers of universally accepted snack food seasoning, tastemakers, specially spice mixes and food ingredients. The company specializes in manufacturing variety of world class dusting mixes with emphasis on Indian taste and appeal for all kinds of snack foods such as:

Potato chips, Banana/Arvi/Tapioca/Tortila chips/Arvi, Corn/Rice/Wheat/Gram Flakes, traditional Indian Snacks like Bhujas, Namkeens, Farsans, Chana Dal, Moong Dal etc., Ready to Eat Fried Snacks, Ready to Eat Roasted Snacks, Ready to Eat directly expanded/extruded Snacks, Ready to Fry Pellets, Pop Corns, Pasta Products, Enrobed Snacks, Cereals and Nuts, Soya Nuggets, Other Products.

The company has sufficient back up information and experi-

ence on extrusion technology which is shared without obligation with the clients for developing magic taste for an end product. UFF dusting mixes have an unique feature of instant self adhesiveness on any snacks. The company manufactures mixed seasonings exclusively for snack food industry. Customers satisfaction is of paramount importance to the management of the company. The company maintains a strict confidentiality about their clients and clients needs as well as new developments.

Most of the raw materials are obtained from processing of agriculture produce of India and the main aspect of the company does not depend upon imported or synthetic raw-materials. Unrestricted supply of 'Tongue-Tingling' seasonings liked by the Indian masses are met without any obstacles, that too, at unbelievable low prices. UFF has added advantage over some other manufacturers whose products are based on either imported or synthetic raw-materials.

The Company headed by Mr. J.B. Patel plans to export the products to Europe, America, Canada and Australia to popularize Indian speciality seasonings in these countries. The company plans to export Indian traditional Snack Food products also in a big way. Manufacturers of Indian Snack Foods may contact the company for export proposals.

For details & requirements, contact:

Universal Food Flavours
133, New Apollo Estate,
Mogra Village Rd.
Andheri (E),
Mumbai 400 069
Tel: 8322631, 8320989
Fax: 91-22-8378156.

MILKFARM FRESH FOODS

Milkfarm - the well trusted name in Ice-Cream, Candy, Cold Drinks & Bakery products. The Company has well established plants in Gujrat State rural area, and all production is looked after by well educated technical staff in fully automatic plants.

Company also manufactures consumer packs in many varieties of instant mixes of Milkfarm brand name, in attractive box. The Company's other Fry 'N' Serve products for export quality are in pipe shapes of many varieties, like Sago pipe, Tomato Sago, Potato Sago, Garlic pipe, Onion pipe, Masala pipe etc. in attractive pouches.

For your requirements, contact:

Milkfarm Fresh Foods
"Milk Farm Nagar"
Gupta Prayag Road,
Delvada 362 510.
Tel: (Office) 02875, (Resi.) 22562
Cable "FOODCHEM"

INDO VANILLON CHEMICALS LTD

Indo Vanillon Chemicals Ltd. (IVCL) has pioneered production of Ethyl Vanillin in India. It has established the world's sixth plant at Sohna, Dist. Gurgaon, Haryana - 40 kms. from Delhi. The Company has been promoted by technocrats with equity participation from Haryana State Industrial Development Corporation (HSIDC). The Promoters possess wide industrial exposure of over 38 years with a distinction of transfer of various technologies to India in the field of Chemical Industry.

Ethyl Vanillin is used as a flavouring agent in Biscuits, Ice-creams, Cakes, Pastries and Chocolates. It is also used as a perfuming agent in perfumes, soaps, detergents, agarbatti, dhoops, cosmetics & toiletries. 1 kg. of Ethyl Vanillin replaces 3 kgs. of Vanillin in intensity, strength and taste.

The Company has been importing one of the raw materials, namely Catechol which constitutes a major part of the total cost of Chemicals. As a backward integration venture, the company is setting up a project to manufacture Catechol. This project when complete, shall be the first of its kind in the country. It will result in tremendous savings and increased profitability to the Company.

For details & requirements, contact:

Indo Vanillon Chemicals Ltd.

245, Sector-17,

Gurgaon - 122 001 (India)

Tel: 0124-343245, 341976

Fax: 91-0124-343245.

NARMADA FOOD COLOURS

Narmada Food Colours Pvt. Ltd., is a unit of the Dadajee Dhackjee Ltd. Group. Dadajee Dhackjee is a household name in edible food colours. Narmada Food Colours having its factory at Bhavnagar, Gujarat, is set up for exclusive manufacture of Primary Food Colours.

The Factory having R & D wing and qualified technical personnel lays importance on quality. The food colours conform to the specification laid down by the Bureau of Indian Standards.

With the vast dealer network and satisfied customers, Narmada Food Colours has made its presence felt in the food colour industry. Today it is one of the leading brands in India. Sizeable quantities have also been exported.

For further details, please contact:

Narmada Food Colours Pvt. Ltd.

56/58, Garibdas St., Vadgadi,

Bombay 400 003.

Tel: 3424161/62. Fax: 91-022-3432854.

SAISHA INDUSTRIAL CORPORATION

Citrus Colloids Ltd. (CCL) of Hereford, England, UK - (CCL) is now a world-wide name for excellent quality Pectins. CCL (formerly known as Bulmer Pectin) is a specialist company solely dedicated to the production and distribution of Pectin. They have been producing pectin since 1937 and today, with

modern manufacturing plants in the UK and Brazil, they are one of the largest producers of pectin in the world. CCL were the first pectin producer to achieve ISO 9000 Quality Standard. Twice in recent years CCL have received coveted Queen's Award for Export Achievement.

CCL's dedicated technical experts provide customers around the world with technical support, including seminars, problem solving and new product development. CCL's pectins are very versatile and tailor made different types of pectin are produced to meet specific customer requirement. CCL in fact offers more than 30 different pectins and each type has dozens of different applications.

CCL are also continuously innovating their production technology; some time back they installed a new 'state-of-the-art' evaporator costing one and half million Sterling Pounds. This sophisticated equipment runs faster than a jet engine, reuses its own energy, thus reducing running costs. It also enables CCL to produce a greater quantity of best quality pectin

For further details, contact:

Saisha Industrial Corporation

Saisha House,

386, HAL Second Stage,

Bangalore - 560 008.

Tel : (080) 5280255

Fax : (080) 5282384

Grams : JUNIPER

JAY CHEM MARKETING

'Jay Chem Marketing' incorporated in 1988 is a professional marketing organisation distributing various food chemicals + additives. The company supplies to the leading Indian and multinational companies using Sorbic Acid, Potassium Sorbate, Monosodium Glutamate, with regular service at competitive prices. Companies using these products are requested to contact Jay Chem Marketing for procurement of these products at competitive prices.

For further details, contact:

Jay Chem Marketing

5, Shanti Sadan, 2nd Flr.,

Kamla Nehru Cross Road 1,

Kandivli (W), Mumbai 400 067.

Tel: 802 01 41, 806 13 37

Fax: 806 13 37

ADITI PECTINS

Aditi Pectins offer standard quality Citrus Pectins, Lime Oil, which are major ingredients in Food Industry. Other Lime products viz. Calcium Citrate, Sodium Citrate, Lime Juice Concentrate/ Squash etc. are also in high demand.

The Company manufactures a wide range of fruit products, such as Pulps, Bars, Squashes, Juices of Mango, Banana, Strawberry, Pineapple etc. and Tomato Ketchup, puree, paste.

These products can be supplied in consumer packs or bulk quantities, as per requirement.

Distributors and Exporters are welcome for regular requirements.

For details, please contact.

Aditi Pectins Pvt. Ltd.

M.I.D.C., Plot No. B/8, Islampur 415 409

Dist. Sangli (M.S.)

Tel : (02342) 22343, 22348, 57550

Fax : (02342) 23064.

ACE INTERNATIONAL

Gum Acacia, Gum Guar, Gum Tragacanth, Gum Ghatti, are Stabilizers, Thickeners, Emulsifiers supplied and guaranteed by Ace International as passing the microbial tests. Export enquiries are solicited:

For your requirements, contact:

Ace International

13/21 Laura Bldg., 1st Flr., Office No. 5B,

1st Dhobi Talao Lane, Bombay 400 002

Tel: 2001413, 2008169

Fax: 91-22-2093240

SESU TRADING CORPORATION

In increasing numbers, consumers in the food and beverage industry are turning to natural products to ensure the quality of life. Legislation in most countries, including India, is now supporting the demand for removal of synthetic colours from lists of approved food additives.

Chr. Hansen's of Denmark now offer an extensive range of natural colours including customerized blends through their world-wide application technological laboratories.

For further details, contact:

Sesu Trading Corporation

Sai Chambers,

367/69 Narsi Natha Street, Bombay 400 009

Tel : 341 4444/ 342 6402

Tlx : 011 72247 SESU IN. Fax : 022-3420832

ALOK CHEM CORPORATION

From the renowned company, Alok Chem Corporation comes Gum Alginate a wonderful Stabiliser/Thickener/Binder which finds application in various food products:

i) As an Emulsifier cum Stabilizer for Ice Cream, Dairy and Non-Dairy Food products. (ii) As a Stabilizer cum Thickener for Sauces, Soups & Canned Convenience Foods (iii) As Bread Improvers for Bakery Products (iv) As a very special quality product for melted cheese, Cheese Spreads, Soft Cheese (v) For Jams and Jellies, RTS Beverages and a range of food applications.

For your requirements, contact:

Alok Chem Corporation,

406 Goradia House,

100/104 Kazi Sayed Street,

Bombay 400 003.

Tel: 3426390/ 5365/3415668.

Fax: 91-22-341 5668

KULU AROMATICS

Kulu Aromatics from Shamshi are manufacturers and exporters of a wide range of Essential Oils and Herbal Extracts. Among their products are Oils of Chamomile, Angelica, Celery, Cade, Juniper, Ginger, Sugandhkoka, Apricot, Aloe, etc. Also nutmeg butter, mango butter, wheat germ, hops, canned baby corn, dried mushroom morels.

For your requirements, contact:

Kulu Aromatics,

Shamshi 175126

Cable: Aromatics.

Tel: 91-1902-65179

Fax: 91-1902-22720.

S.A. CHEMICALS

S.A. Chemicals with a global vision in mind has been surging ahead at an impressive speed to service the ever increasing needs of its customers. Qualified promoters, professional marketing team, emphasis on quality, effective after sales service, timely and prompt dispatches and cost effectiveness are the company's trademarks.

Sorbitol, available in abundance from fruit like black Grapes, apples, plums, cherries, pears, find application in Foods and Beverages such as Candies, Drinks, Cereals & Snacks etc. as well as cosmetics, textiles, synthesis of rigid polyurethane foams.

Dextrose, a monosaccharide sugar finds application in food and beverages like jams, jellies, icecream, chewing gums, meat, beer. etc.

Liquid Glucose known as Glucose or Corn Syrup finds application in Confectionery, Bakery products, Ice Creams, etc.

Malto Dextrin (Spray dried), used in infant food/feed supplements, beverages, bakery and snack foods, dairy, confectionery, dry mixes, sauces and salads, is a spray dried product.

Other corn based products and modified starches are: Refined Corn Oil, Maize gluten, Corn Steep Liquor, Dextrin, Oxidized Starch, Starch Ester.

Besides the above, S.A. Chemicals supply Casein, Folic Acid, Sodium Hydrosulphite, Calcium Carbonate, Lactose, Ascorbyl Palmitate, Calcium Gluconate.

For your requirements, contact:

S.A. Chemicals,

4/33 Malad Co-op. Hsg. Soc. Ltd.,

Poddar Park, Malad (E)

Bombay 400 097

Tel: 022-883 9590 (5 lines)

Fax: 022-883 5347

ALVIN CHEMICALS (INDIA)

Established in 1979, Alvin began its operations with the sole objective of manufacturing Caramel Colours of all types. "Innovate and Serve" has therefore become the motto of Alvin.

Quality and Hygiene: Alvin's 'Tailor made' Caramel Colours conform to I.S.I. as well as the U.S. & E.E.C. standards. They have a well equipped analytical and R & D laboratory.

Image through service: Timely supplies, prompt communication and sincere services have made Alvin a name to reckon with in India and abroad. Many companies have been able to reduce their inventories substantially. Alvin believes in caring for the image of its customers as much as it does for its own.

For more details, write to:

Alvin Chemicals (India) Pvt. Ltd.
W-9, M.I.D.C.
Ahmednagar 414 111
Tel: 0241-77914. Fax: 0241-41824

LAKH ENTERPRISES

Lakh Enterprises are manufacturers of custard powder, jelly crystals, agar-agar (china grass), baking powder, cocoa, ajinomoto, corn flour, caramel puddings, icing sugar and other food products.

For details, contact:

Lakh Enterprises
182 Yusuf Meherali Rd.,
1st Flr.,
Bombay 400 003
Tel: 91-22-3755661
Tlx: 011-75096 PCOE IN
Gram: BRISTA FOOD.

VIDHI DYESTUFFS MFG. LTD.

Vidhi Dyestuffs are manufacturers and exporters of a range of basic Food Colours such as Tartrazine, Sunset Yellow, Carmoisine, Carmine, Allura Red, Red RG, Chocolate Brown, Indigo, Brilliant Blue, etc. Besides these, blended and diluted colours like Orange-Red, Cherry-Red, Strawberry Red, Egg-Yellow, Lemon-Yellow, Violet, Rose-Pink are also manufactured by the company.

For your requirements, contact:

Vidhi Dyestuffs Mfg. Ltd.
E-27, Commerce Centre, 78 Tardeo Rd.,
Near A.C. Market,
Mumbai 400 034.
Tel: 342 3512, 341 1369
Fax: 342 7529, Tlx: 71885 MIHI IN.

FINE ORGANICS

For many years Fine Organics has been producing a variety of fatty acid esters for the food industry.

Smoothex fat based Emulsifiers are of great importance in today's food industry. The Smoothex range of products find application in a wide range of food products.

Smoothex GMS is widely used as an emulsifier in Ice creams, while use of Smoothex-GMS in fermented goods has almost become a standard practice with Bakers who produce

quality goods at economical price. The use of Smoothex-GMS ensures better quality production of Bread and Cakes.

In the manufacture of yeast, water tends to sweat and leave a dry, crumbly cake that is difficult to cut. Addition of 0.1% Smoothex-GMS to the yeast in the last mixing operation results in a clean cutting product which is whiter in appearance and does not sweat.

Smoothex-GMS improves Toffees/Chocolates in many ways, and Non-self Emulsifying grade GMS (NSE) is suggested for Chewing Gum.

Smoothex-GMS as an emulsifier reduces the interfacial tension between oil and water surfaces resulting in a stable emulsion.

Peanut Butter contains approximately 50% Peanut Oil compounded in Peanut fibres. On standing Peanut oil separates from the fibres. The separated oil impairs the product's appearance and palatability. Smoothex GMS can be added to crystallize part of the free oil during processing and thus prevent the oil and peanut fibres from separating during storage.

Smoothex-GMS is suggested as an emulsifier in producing high quality biscuits.

Smoothex-GMS is used to emulsify the meat fats and assist the binders in sausages products.

Smoothex-GMS is also suggested for use in both, liquid and spray dried coffee whiteners. Other uses are in Noodles and extruded foods, as well as starch based food products.

In starch jelly confections, starch crystallization is the major cause of hardening. Although moisture loss may appear to be the cause of staling, it is observed that firming will proceed even when moisture loss is prevented. The use of Smoothex-GMS at the level of 0.1% of 0.3% will retard starch crystallization and extend the palatability of this confection.

Finacon - CAC a beverage clouding agent and **Finesse** - a pan releasing agent for bread, are other high quality products from Fine Organics.

For your requirements, contact:

Fine Organics
15/2 Neelkant Market, M.G. Road,
Ghatkopar (East), Bombay 400 077.
Tel: 5116900-02, 5154384, 5154380, 5154495, 5154394,
5153041, 5153356, 5153397, 5153440.
Fax: 022-5153215, Tlx: 011-7 3311 FINE IN

DRYTECH PROCESSES (I) PVT. LTD.

To fulfil your diverse requirements, Drytech Processes (I) Pvt. Ltd. manufacture ready-to-use Gum Arabic. Spray dried Gum Arabic is pure, free from impurities with uniform quality and viscosity. It is free flowing, with low moisture content thus ensuring longer shelf life. It saves on processing time, and cuts power and labour cost.

The unique properties of Spray Dried Gum Arabic include emulsifying, stabilising, coating, binding and encapsulating. With the added advantages of adhesivity and calorie control, Gum Arabic is widely used in the manufacture of food flavours, soft drink, confectionery, chewing gum, coated nuts, bakery icing, syrups, diabetic and dietetic foods, asafoetida, cattle feed,

GOOD NEWS

FOR FOOD INDUSTRIES

INDOFARIN

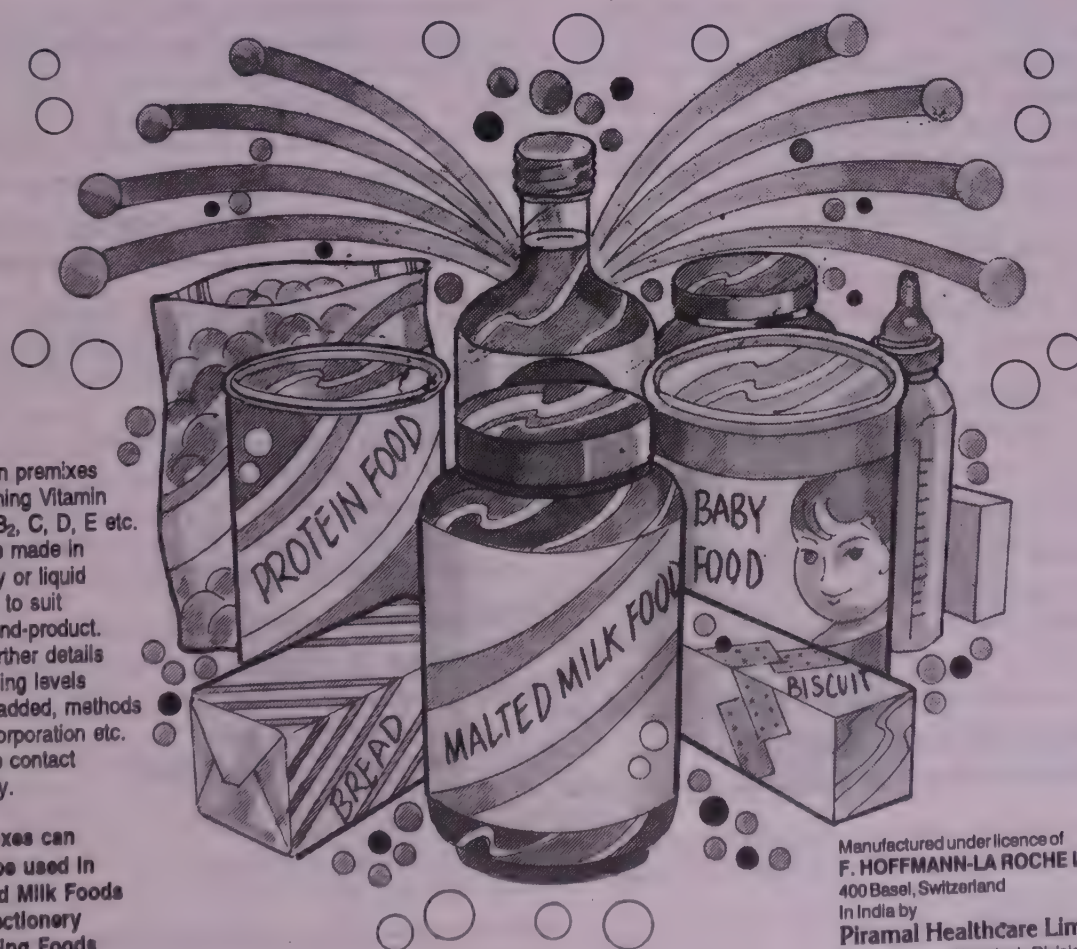
FOOD PREMIXES

SPECIALLY MADE TO SUIT
YOUR END-PRODUCT

INDOFARIN FOOD PREMIX FOR ADDED NUTRITION TO PRODUCTS
LIKE BREAKFAST CEREALS, BREAD, BISCUITS, PROTEIN FOOD, JUICES & OTHER BEVERAGES

Vitamin premixes containing Vitamin A, B, B₂, C, D, E etc. can be made in dry, oily or liquid forms, to suit your end-product. For further details regarding levels to be added, methods of incorporation etc. please contact directly.

Premixes can also be used in
Malted Milk Foods
Confectionery
Weaning Foods



Manufactured under licence of
F. HOFFMANN-LA ROCHE LTD.
400 Basel, Switzerland
In India by
Piramal Healthcare Limited
Vitamin & Fine Chemicals Division
Bombay-Agra Road, Belkum, P.O. No. 33
Thane-400 606.

INDOFARIN A REAL BOOSTER TO YOUR PRODUCT

medicinal tablets, etc.

For your requirements, write to:

Drytech Processes (I) Pvt. Ltd.
B-16 Girikunj Industrial Estate,
Mahakali Caves Road, Andheri (East),
Bombay 400 093
Tel : 8378915, 8326494, 8301918
Fax : 022-8367442, 8364753

RUPANDE FRUIT PRODUCTS

Herbs add a gourmet touch to plain cooking and have a wide variety of uses. For example, the Basil leaf is used in soups, omelettes, cottage cheese, fish sauces, stuffings, meat and vegetable preparations. So also Chives (stems) added to soups, omelettes, cottage cheese, hamburger sauces, vegetables, salads, give a delicate onion flavour. The sweet spicy flavour of Marjoram leaves and the versatile Parsley leaf enhance the flavours of stuffings in Duck and Turkey roasts, besides being used in marinades, stews, etc.

Sage, Rosemary, Thyme are used in tea as infusions, and impart their own unique flavours to pork, lamb, stews, besides enhancing vegetables, salads, cheese and egg dishes and soups. The Oregano leaf is specially used in Pizzas and Pastas, and also in Broccoli and Mushroom dishes. Italian, Mexican and Spanish preparations use this herb lavishly. Mint (Pepper & Spear), either ground or chopped is used for Kabab dressings, in salads and in sauces and chutneys. Celery stalk is very popular in Chinese cooking, while the leaves are used in Salads.

Herbs are natural flavourings, enjoyed specially by the diet conscious as they are calorie-free. A *bouquet garni* - an aromatic bundle of herbs made from thyme, parsley, marjoram, gives variety to vegetarian cooking.

Herbs are used by housewives, hoteliers and caterers. All these herbs are now available in India from Rupande Food Products.

For your requirements, contact:

Rupande Food Products
52 Shivajinagar, N.M. Joshi Marg
Lower Parel (E), Mumbai 400 013
Tel : 306 0357

VIDARBHA FRUIT PRODUCTS

Vidarbha Fruit Products Pvt. Ltd. now manufacture International Standard Pectins at its highly sophisticated modern plant.

The product range comprise Citrus Pectins, Lime Oil, Processed Lime products such as juice concentrate, squash, cordial, etc.

For your requirements, contact:

Vidarbha Fruit Products Pvt. Ltd.
B/1 Rajdarshan Basement - B
Opp. Rly. Platform No. 6
Thane (W) 400 602
Tel : (022) 5404782
Fax : (07234) 27049

HI MEDIA LABORATORIES

Man's early search for microbe and eventual study of this tiny world of the microbe is today a flourishing science of microbiology. This science, as we know, depends on numerous growth supporting culture media. Used for invitro testing and identification of microbial presence, these culture media are an invaluable tool in diagnostic laboratories and in pharmaceutical quality control.

Culture media find application in Dairy, Breweries & Distilleries, Bakeries & Food Processing, Pharmaceutical & Cosmetics, Immunological Research, Cancer Research, Pharmacology Testing Purity of Drinking water, Plant Tissue Culture, and in Floriculture

A comprehensive range of Culture Media is available in standard packs, as also a range of Plant and Animal Tissue Culture Media.

The success of Hi Media & R & D labs in developing on its own over 1000 culture media have few parallels in the world of science and technology.

For more details, write to:

Hi Media Laboratories Pvt. Ltd.
23 Vadhani Industries Estate, Bombay 400 086
Tel: 515 0970, 515 1607.
Grams: STERILITY
Tlx: 011-74429 HIGH IN. Fax: 022-5112468

OLIN CHEMICALS

Olin Chemicals are dealers, importers & suppliers of Food Grade Chemicals. The company offers a wide product range of Antioxidants, Aromatic Chemicals, Enzymes, Natural Essential Oils, Natural Food Colours, Gums, Waxes and Solvents. The company supplies Food Grade Chemicals, Essences & Flavours for Ice Cream, Confectionery, Beverages & Processed Food Industries. Also, the company introduces speciality dairy chemicals like Rennet, Dairy Cultures (for making Cheese, Yoghurt, Dahi) & Antioxidants & Anti Fungus Agents.

For your requirements, please contact :

Mr. Rajesh R. Sanghvi,
Olin Chemicals
A-303, Padmavati Nagar,
Gen. Arunkumar Vaidya Marg,
Goregaon (E),
Bombay 400 063.
Tel : 840 69 88, 841 31 11
Fax : 873 43 32

RAKESH SANDAL INDUSTRIES

The Rakesh Sandal Industries Pvt. Ltd., located at Kanpur and established in 1972 is a 100% export oriented unit, manufacturing primarily all natural essential oils, spice oils, spice aromatic chemicals and oleoresins.

Members of various trade organisations, the Rakesh Group of Industries strives to maintain a high standard. While Rakesh Sandal Industries Pvt. Ltd. is the Parent company, other associated

ate companies include Rakesh Products, Rakesh Exports and Rakesh International.

Other products exported are Herbal Extracts, Sandalwood products, Indian Attars, Botanical Extracts, Agarbatti Raw Material and Perfumery Compounds.

For your requirement, contact:

Rakesh Sandal Industries

7/177-A Swaroop Nagar,

Kanpur 208002, U.P.

Tel: 214071, 294693. Fax: 91(512) 294675.

TLx: 81-325-484 RSIK-IN

WARKEM

The Warkem range covers both, a refined and a technical series of hydrolyzed proteins. This broad range comes from the use of various protein sources, digestion techniques and processing methods under controlled conditions.

The main protein sources are derived from milk, soyabean, meat, liver, collagen, yeast and groundnut. All these protein sources are of pharmaceutical or food grade where nutritive part is controlled to preserve its natural form besides scrupulously maintaining a low bacterial content, as per U.S.P. and I.P.

A broad spectrum of hydrolyzed proteins: L-Casitose - 20%, L-Casitose - 30%, L-Casitose with Iron, P-Casitose - 55%, P-Casitose - 75%, PH-Casitose with Iron, L-Soyatose, P-Soyatose - 55%, P-Soyatose - 85%, PH-Soyatose, P-Collagen, HVP, P-Protose.

Different types of enzymes, modifying the mineral content, and adjusting the process conditions are main features of Warkem series.

The Warkem range is used in a number of applications which include Pharmaceuticals, Food & Diets, Fermentation Nutrients, Culture Media bases, Cosmetics & Personal Care, and Veterinary products.

For your requirements, contact:

Warkem

23 Vadhani Industrial Estate,

L.B.S. Marg, Bombay 400 086

Tel: 5148746

PRAJA ENTERPRISES

Praja Enterprises located in Calcutta with its factory at Cuttack, Orissa supply a wide variety of Essencial Oils, Agro Oils, Fine and Purified Chemicals & Compounds.

Your requirements of the following are available from Ready/Incoming stocks: Anise Oil, Bergamot Oil, Clove Leaf Oil, Eucalyptus Oil, Ethyl Vanillin, Geranium Oil, Vanillin, Linalool, Lavender Oil, Nutmeg Oil, Basil Oil, Ylang Ylang Oil, Lemon-grass Oil, Tannic Acid, Citronella Oil, Aldehyde C-18, D-Limonene, Ethyl Maltol, Palmarosa Oil, Orange Oil as well as a host of other chemicals and compounds you may require.

For further details, write to :

Praja Enterprises,

38/1 CIT Scheme No. XLV, (11 Ezra Street)

Calcutta 700 001

Tel: 2254099, 2253348

Fax: (91) (33) 2479738.

PIRAMAL HEALTHCARE LIMITED

Speciality foods and beverages are gaining in importance in today's markets and consumers.

Pre-mixes for added nutrition to products like breakfast cereals, bread, biscuits, protein foods, juices and other beverages are manufactured under licence of F. Hoffman - La Roche Ltd. by Piramal Healthcare Limited. Vitamin Premixes containing Vit. A, B, B₁₂, C, D, E, etc. can be in dry, oily or liquid forms to suit end-products. Premixes can also be used in malted milk products, confectionery, weaning foods.

For details regarding levels to be added, methods of incorporation, please contact the company.

For your requirements, contact:

Piramal Healthcare Limited

Vitamin & Fine Chemicals Div.,

Bombay-Agra Rd.,

Balkum, P.O. Box 33,

Thane 400 608.

KIRAN KOTAK & CO.

The Company are wholesale dealers of Milk Powder, GMS, CMC, Sodium Alginate, Cocoa Powder, Gelatine Powder, Citric Acid, Agar Agar (China Grass), Pectin, Yeast, Ajinomoto and a range of other products.

For your requirements, contact:

Kiran Kotak & Co.

414/418,

M.J. Phule Market,

Bombay 400 001.

Tel: 3429580, 3442796

Fax: 3429580.

HIGH - TECH FLAVOURS

High - Tech Flavours, established in 1993, are manufacturers of Speciality Flavours for - Biscuit, Bakery, Confectionery, Ice-Cream, Beverages, Jams, Jelly, Tobacco, Liquor & Processed Food Industry.

The following flavours were developed by Dr. Dinesh Mhatre Ph.D. (Tech). UDCT Bom. through R & D.

Bakery Vanilla 406901 : At 1% dosage level imparts delicate & rich vanilla flavour to biscuits and cakes. Orange (Double Strength) 460303: Superior replacement for cold-pressed imported orange oil. It imparts a better juicy orange flavour. This is recommended at 50% dosage. Cardamom 401402: A powerful flavour which imparts a real cardamom taste to the product due to its 100% nature - identical character. Lemon (Double Strength) 406505: A new generation uncommon lemon flavour. To be used at 50% dosage compared to regular cold-pressed lemon oil.

We can also match your existing flavours with our cost-effective R&D flavours for substantial savings in costs of materials and life-span.

For your requirements, please contact:

High-Tech Flavours

Attn. Dr. Dinesh Mhatre Ph.D (Tech)
Saraswati Niwas, V.S. Agashe Road,
Dadar (W), Mumbai - 400 028.
Tel: 437 2164.

GANESH BENZOPLAST LTD.

High Quality Food Preservatives are manufactured by Ganesh Benzoplast at its computerised controlled manufacturing plant, e.g. Sodium Benzoate, Benzoic acid and Fumaric acid.

Sodium Benzoplast is bactericidal, tasteless, odourless and non-toxic and finds application in Squashes, Sauces, Crushes, Jams, Jellies, RTS Beverages, Juices, Pickles, Sherbats and a host of other fried & beverage products. Fumaric Acid is an acidulant and can replace citric acid in its usage.

Benzoic Acid IP/BP/USP is also manufactured by the company.

For your requirements, contact:

Ganesh Benzoplast Ltd.

Ganesh House,
Marol Naka, Andheri (E)
Mumbai 400 059
Tel: 838 2096. Fax: (91) (22) 839 1529.

GUJRAT ESSENCE MART

The company is a leading well-known organisation in the field of Flavours, Flavouring Essences, Emulsions, Essential Oils, Food Colours, Saccharin and Perfumery Compounds.

These products are widely used in the Biscuit, Bakery, Confectionery, Jam, Jelly, Cold Drinks, Juices, Beverages, Fast Food, Processed Food, etc.

For your requirements, contact:

Gujrat Essence Mart Pvt. Ltd.

Keshav Baug, 124/126 Shamaldas Gandhi Marg,
(Princess Street)
Bombay 400 002
Tel: 2011449/2017214. Fax: (91-22) 8380164
Tlx: 011-79124 ACWB IN Attn: GEMPL.

FAB FLAVOURS & FRAGRANCES

This Delhi based company manufacture a wide range of Food Additives including Culinary Essences, Flavouring Essences, Emulsions, Dusting Flavours, Food Colour Preparations, Beverage Clouding Agent. They also have Speciality Flavours for the IMFL (Indian Made Foreign Liquor) and Pharmaceutical Industries. Various fragrances are also manufactured by them.

For your requirements, contact:

Fab Flavours & Fragrances Pvt. Ltd.

70-A, Rama Road,
New Delhi 110 015
Tel: 545 1142, 543 1556
Fax: 91-011-291 3599.

FEROZE FOODS & FLAVOURS

Feroze Foods & Flavours are well known manufacturers of **Avan** soft drink concentrates which are available in eleven different flavours for use in aerated waters, syrups, etc. Manufacturers, Caterers and Hoteliers can use the concentrates for preparation of refreshing soft drinks.

The company also manufactures **FlavorBoy** Food Flavouring and Essences to suit your requirements.

Feroze Foods & Flavours also manufactures Instant China Grass and Jelly Crystals.

For your requirements, contact:

Feroze Foods & Flavours

403, Central Tin Estate,
D. Kondeo Marg, (Sussex Road)
Byculla, Bombay 400 027.

VINO SYNTH CHEM

Vino Synth Chem Pvt. Ltd. will meet your requirements of ISI marked Food Colours. **"VINOL"** brand basic Food Colours such as Tartrazine, Sunset Yellow, Carmoisine, Ponceau 4R, Erythrosine and **"SUNNY"** blended Food Colours (Liquid & Powder) such as Lemon-Yellow, Orange, Orange-Red, Kesar, Green, Raspberry-Red, Chocolate, Tomato-Red, Rose-Red, Rose-Pink, Apple-Green, Pea-Green, Falsa are available for use in your products as well as for export.

For details, write to:

Vino Synth Chem Pvt. Ltd.

404 Bezzola Commercial Centre,
Sion Trombay Rd., Chembur,
Bombay 400 071.
Tel: 5222539, 5228958
Cable: VINOBIN
Fax: 91-22-5222539.

FRESH COCONUT PRODUCTS LTD.

Freshco brand ready-to-use Coconut Cream in 200 ml tins is a concentrated Coconut Milk for use in Curries, Desserts, Ice Cream, Sweets, Confectioneries, in Bakery Products, as well as for bulk use to make Coconut Based Preparations and Beverages. It can also be used in cosmetic cream, shampoo, soaps.

Other Allied Products are Coconut Milk, Low Fat Residue Powders, Chutney Powders, Spray Dried Coconut Milk Powder etc.

The Company can be contacted in Bombay on Telephone No. 6171343, and Fax: 022-6183160.

For further details, write to:

Fresh Coconut Products Ltd.

Kadupissery P.O.
Trichur Dist.
Kerala 680 698
Tel: 0488 867863
Fax: 0488 6304.

KIRAN KOTAK & CO.

WHOLESALE DEALERS IN:

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- * GELATINE POWDER * CITRIC ACID
- * AGAR-AGAR (CHINAGRASS)
- * PECTIN * YEAST
- * AJI-NO-MOTO etc. etc...

For your requirements, please contact:

414/418, M.J. Phule Market
(Crawford Market)
Bombay 400 001
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(R) 8931835/6247950
Fax : 3429580

Estd: 1993

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Apart from matching of existing flavours, we offer you our own Speciality Flavours, which will impart an innovative & new generation character to your products.

Kindly contact: Dr. Dinesh Mhatre, Ph. D.
(Tech). UDCT Bom. HIGH-TECH FLAVOURS

Saraswati Niwas, V.S. Agashe Road
Dadar (W), Mumbai - 400 028. Tel: 4372164

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**READY - TO - USE
COCONUT CREAM - 200 ml TIN
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Confectionaries : To make Chocolates, Chikkies.

Bakers : To make Coconut flavoured Cakes, Biscuits, Cookies.

Caterers : For Bulk use - To make Coconut Based Preparations and Beverages.

Cosmetic & Detergent Mfg : To make Cosmetic Cream, Shampoos, Soaps.

Manufacturers of : Coconut Creams, Coconut Milk, Low Fat Residue Powders,
Chutney Powders, Spray Dried Coconut Milk Powder and other Allied Products.



FOR TRADE ENQUIRIES AND EXPORTS CONTACTS :

FRESH COCONUT PRODUCTS LTD.

REGISTERED OFFICE

Kadupissery P.O.
Trichur Dist.
Kerala 680 698 (India)
Tel : 0488 867863
Fax : 0488 6304

BOMBAY OFFICE

87-Q, Jess Bonn Villa
1st floor, Old CST Road
Kalina, Santacruz (E), Bombay 400 029
Tel : 6171343
Fax : 022-6183160

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Hydrolyzed Proteins constitute by far the most significant human tissue repair and growth material known to man. Significantly they have opened up new frontiers and prospects for building up a truly healthful human society. Some of the key areas in which they are being progressively employed are :

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Bacteriological Raw Materials and Hydrolysed Vegetable Protein (H.V.P.) Contact: **Warkem** 40, Vadhani
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BUYERS' GUIDE

to "Additives & Ingredients" Suppliers

ACE INTERNATIONAL

13/21 Laura Bldg., 1st Fl., Office No. 5B,
1st Dhobi Talao, Bombay 400 002. Tel:
2001413, 2008169. Fax: 91-22-2093240.

Products: Gum Acacia, Gum Guar, Gum
Tragacanth, Gum Ghatti

ADITI PECTINS PVT. LTD.

MIDC, Plot No. B-8, Islampur 415409. Tel:
(02342) 22343, 22348. Fax: (02342).
23065.

Products: Pectin, Lime Oil, Orange Oil,
Orange Oil Juice, Sulphited, clarified Lime
Juice, Cloudy Lime Juice, Tomato Ketch-
up & purée (Alphonso, Totapuri), Mango
Bar, Mango Squash.

AJANTA PRODUCTS CO.

45 West Avenue, Punjabi Bagh, New Delhi
110026. Tel: 503280, 5437299. Fax: 011-
5115171.

Products: Food Colour, Preparations, Bak-
ing Powder

ALOK CHEM CORPORATION

P.O. Box 13048, 406 Goradia House, 100/
104 Kazi Syed St., Bombay 400 003. Tel:
3426390, 3415668. Fax: 91-22-3415668.

Products: Gum Arabic, Gum Tragacanth,
Gum Ghatti, Gum Alginate, Gum Karaya,
Gum Ester. Also Sodium Carboxyl Methyl
Cellulose, Sodium Alginate, Gum
Xanthan, Gum Carrageenan, Locust Bean
Gum - all food grade.

ALVIN CHEMICALS (INDIA) PVT. LTD.

W-9, M.I.D.C., Ahmednagar 414111. Tel:
0241-77914. Fax: 0241-341824. Grams:
CARMEL.

Products: Caramel Colours, Food Colours.

AMBA CHEMICALS

35 Western India House, Sir P.M. Road,
Fort, Bombay 400 001. Tel: 2870566/
2871172. Fax: 91-22-6712845

Products: Sodium Citrate, Sorbic Acid, So-
dium Chloride I.P., Essential Oils,
Flavours, Magnesium Carbonate Light,
Ferrous Sulphate I.P. etc.

AMRUTH STARCH PRIVATE LTD.

Morampudi Post, Hukempeta, Rajah-

mundry 533103. Tel: 61106

Products: Liquid Glucose

ANU CHEM INDUSTRIES

Rm. No. 873, 8th Flr., Marshall House, 25
Strand Rd., Calcutta 700 001.
Tel: 91-33-2205 669, Fax: 91-33-2201558

Products: Dextrines, Liquid Glucose,
Maize Starch, Dextrose, Sorbitol.

AROMA IMPEX

55/57 Nagdevi Cross Lane, 1st Fl., Mumbai
400 003. Tel: 3401109. Fax: 3442211

Products: Aromatic Chemicals, Essential
Oils, Flavouring Emulsions & Essences,
Lemon Oil, Food Flavours, Resinoids

AROMATIK (INDIA)

Post Box No. 2069, Bangalore 560020. Tel:
3363692, 8395799. Fax: 0091-080-
8397352

Products: Flavouring Essences

ARUN CHEMICAL INDUSTRIES

204, Tilak Bazar, Delhi 110064, Tel:
2527499, 2525678. Fax: 91-11-5462564

Products: Food Colours, Flavours, Baking
Powder.

ASHOKA ENTERPRISES

206 Modi Chambers, French Bridge,
Above Ropchand Jewellers, Opera House,
Bombay 400 004. Tel: 3889573, 3755189

Products: Gums, Stabilizers, Additives,
Acids, Antioxidants, Emulsifiers, Preser-
vatives, Dehydrated Foods, Pectin etc.

BALAJI DYECHEM

5 Prafulla Bhavan, 130 Khareghat Rd.,
Dadar, Bombay 400 014. Tel: 5610530,
5611117. Gram: BALAJI CHEM, Bombay
400 080.

Products: Additives, Food & Beverages

BASIL & CO.

136, Nyniappa Naick St., Madras 600003,
Tel: 5355609, 5350891. Gr: LALHEERA

Products: Aromatic Chemicals.

BURZIN & LEONS AGENTUREN PVT. LTD.

Readymoney Bldg. No. 1, Sir Ratan Tata
Marg, Tardeo Rd., Bombay 400 034. Tel:
4944616, 4921255. Fax: 91-22-4930283.

Products: Refined Sodium Alginate, Gel-
ling Grade Sodium Alginate, Propylene
Glycol Alginate, Dairy Stabilizers, Emul-
sifiers, Ice Cream Stabilisers, Potassium

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Phone : 2017214, 2011449

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- * ESSENTIAL OILS * EMULSION * OTHER CHEMICALS.

Alginate, Xanthan Gums, Gellan Gums.

CASEIN CORPORATION OF GUJARAT

Bhalei Road, Near Samerkha Rly. Crossing Anand 388001. Tel: 23993

Products: Casein

CAXTON PHOSPHATES & AGRO CHEMICALS PVT. LTD.

503, Cornelian, 104, August Kranti Marg, Bombay 400 036. Tel: 385 3813, 388 0543, 375 0525, 375 3491. Gr: Caxchemind, Bombay 400 036. Fax: 91-22-3738012

Products: Sodium Alginate, Alginic Acid, Agar Agar Powder/Strips, Di Calcium Phosphate, Tri Calcium Phosphate, Light Magnesium Carbonate.

CHANAKYA ENTERPRISES

157 Sonawala Bldg. No. 2, Tardeo, Bombay 400 007. Tel: 3086000, 3087356. Fax: 3089365

Products: Blended Spices, Masala Pastes, Curry Powders.

CHEMICAL PROCESS CONSULTANTS

137 Adarsh Industrial Estate, Chakala, Sahar Road, Andheri (E), Bombay 400 099. Tel: 8325855, 8351337

Products: Essential Oils.

CITURGIA BIOCHEMICALS LTD.

Neville House, J.N. Heredia Marg, Ballard Estate, Bombay 400 038. Tel: 2618071, Fax: 261 3519. Gram: Citurgia

Products: Citric Acid

DAVARS M.P. ORGANICS

Tansen Road, Gwalior 474002. Tel

330841, 326888, 421061. Fax: 0751-332278

Products: Stabilisers, Emulsifiers, Improvers, Other Additives

DE WANG CORPORATION

S-3, Navrang, Swastik Char Rasta, Navrangpura, Ahmedabad 380009. Tel: (91-79) 6568012, 380009. Fax: (91-79) 442109, 462009

Products: Aromatic Chemicals

DHIR & DHIR

261 H.B. Colony, Baldev Nagar, Ambala City 134007. Tel: 540333

Products: Chemicals, Stabilizers, Emulsifiers, Food Colours, Flavours, Preservatives

DHOOT DAL MILL

E-287, M.I. Area, Phase 11, Basni, Jodhpur 342005. Tel: 0291-41264, 41880. Fax: 029-41045

Products: Guar Gum Powder

DRYTECH PROCESSES (I) PVT. LTD.

B-16, Girikkunj Industrial Estate, Mahakali Caves Rd., Andheri (E), Bombay 400 093. Tel: 8378915, 8326494, 8301918. Fax: 022-8367442.

Products: Spray Dried Gum Arabic and Acacia

DUNGRA CHEMICALS PRIVATE LTD.

3rd Fl., Meadows House, Nagindas Master Road, Fort, Bombay 400 023. Tel: 91-22-2656783. Fax: 91-22-2654154

Products: Sodium Metabisulphite, Potas-

sium Metabisulphite, Sodium Thio Sulphate (anhy), Sodium Carbonate, Sodium Acetate (anhy), Sodium Sulphite.

EASTERN TRADING CORPORATION,

C/o. Kishor V. Shah, Sonarika Apt., 1st Fl., Flat No. 1, Chanda Wadi, 138 C.P. Tank Road, Mumbai 400 004. Tel: 3885868

Products: Papains, Enzyme Chemicals, Dehydrated Mushrooms

FAB FLAVOURS & FRAGRANCES PVT. LTD.

70-A Rama Road, New Delhi 110015. Tel: 5451142, 5451142, 5431556. Fax: 91-011-2913599

Products: Emulsions, Culinary Essences, Food Colour Preparations, Food Flavours, Flavouring Essences, Dusting Flavours, Beverage Clouding Agent, Soft Drink Concentrates, other Food Additives and Fragrances. Also Special Flavours for IMFL and Pharmaceutical industries.

FEROZE FOODS & FLAVOURS

403 Central Tin Estate, D. Kondeo Marg, (Sussex Rd.), Byculla, Bombay 400 027. Tel: 3729724/3640341. Fax: 3640341

Products: Food Flavourings and Essences. Also Soft Drink Concentrates, Jelly Crystals, Instant China Grass.

FINE ORGANICS

Food Chemicals Div., 15/2 Neelkanth Market, M.G. Road, Ghatkopar (E), Bombay 400 077. Tel: 5116900/5154384, 5154380. Fax: 91-022-5153215. Tlx: 011-73311 FINE IN

Products: Finacon-CAC (Beverage Cloud-

ing Agent Concentrate), Food Emulsifiers: GMS, SSL, Distilled Monoglycerides, etc. Bakery Preservatives: Calcium Propionate, Sodium Propionate, Finesse (Pan Release Agent for Bread)

FOOD ASSOCIATES BANGALORE

No. 132, 17th Cross, 11th Main Rd., Malleswaram, Bangalore 560055. Tel: 080-3340038. Cable: FABFOOD. Fax: 91-80-3347318

Products: Tamarind Powder & Paste, Herbs, Spices

FOODS, FATS & FERTILISERS LTD.

Fountain Plaza, 7th Fl., Pantheon Rd., Egmore, Madras 600 008. Tel: 8252705, 8262449. Fax: (044) 8263365

Products: Stearic Acid, Glycerine, Fatty Acids, Stearine, Margarine, Vanaspati, Rice Bran Oil

FRESH COCONUT PRODUCTS LTD.

Kaduppissery P.O., Trichur Dist., Kerala 680698. Tel: 0488-867863. Fax: 048-6304

Products: Coconut Cream, Coconut Milk, Chutney Powders, Spray Dried Coconut Milk Powder, and allied products.

G.K. PRODUCTS

11, Shanti Nagar, Lawspet, Pondicherry 605008.

Products: Flavouring Essences

G.R.S. CHETTY & CO.

216, Thambu Chetty St., Madras 600 001. Tel: 510073. Fax: 510073

Products: Madras Curry Powder, Spices, Tamarind, etc.

GANESH BENZOPLAST LTD.

Ganesh House, Marol Naka, Andheri (E), Mumbai 400 059. Tel: 8382096, 8506997,

8508276, 8505645, 8506401. Fax: 91-22-8391529

Products: Food grade Preservatives such as Sodium Benzoate, Benzoic Acid, Fumaric Acid.

GENERAL AROMATICS P. LTD.

213, Tirupati Ind. Estate, Village Rd., Subhashnagar, Bhandup, Bombay 400 078

Products: Flavouring Compounds

GIPSICKO LABORATORIES (P) LTD.

37, 41 Mahalaxmi Indl. Estate, Village Iyava, Ta. Sanand, Dist. Ahmedabad 382110. Tel: (079) 2873537, 2113772. Fax: 91-079-5838408. Gram: Gipsicko

Products: Sodium Citrate, Sodium Acid Citrate, Sodium Citrate, Anhydrous USP., Citric Acid, Sodium Chloride, Sodium Benzoate, Phenyl Butozone, Sodium Acetate.

GUJARAT ESSENCE MART PVT. LTD.

124/26 Keshav Baug, Shamaldas Gandhi Marg (Princess St), Bombay 400 002. Tel: 2011449, 2017214. Tlx: Attn:011-79124 ACWB IN. Fax: (91-22) 8380164.

Products: Essences, Dry Flavours, Essential Oil, Emulsions, Food Colours, Saccharin, Mustard Oils, Other Chemicals

HARISH C. KHOSLA & CO.

Zinat Mahal, LI Kuan Bazar, Delhi 110006. Tel: 7524803, 733160. Fax: 01-75 24403.

Products: Flavouring Essences, Essential Oils, Aromatic Chemicals, Capsaromas, Saccharin.

HELIOS FOOD ADDITIVES PRIVATE LTD.

421, Swastik Chambers, Chembur,

Bombay 400 071

Products: Cake Gel, Cake Improver, Custard Powder, Baking Powder, Tutti Frutti

HICKSON & DADAJEE LTD.

Shree Pant Bhuvan, Mamasahab Warerkar Bridge, Bombay 400 007. Tel: 3633947/3633968. Fax: 91-22-3640604.

Products: Food Colours, Dye Intermediates.

HIGH TECH FLAVOURS

Saraswati Nivas, V.S. Agashe Rd., Dadar (W), Bombay 400 028. Tel: 4372164

Products: Speciality Flavours.

HI MEDIA LABORATORIES

23 Vadhani Industrial Estate, LBS Marg, Bombay 400 086. Tel: 515-1607, 515-0970. Fax: 91-22-5112468.

Products: Chemicals, Food Culture Media, Yeast Extract, Peptone, L. Lysine Monohcl, Agar Agar, Yeast Extract, HVP, Protein Hydrolysates, Casein, Lactic.

HINDUSTAN CHEMICALS INDUSTRIES

77-B, Juhu Supreme Shopping Centre, Gulmohar Road, Juhu, Bombay 400049. Tel: 6205464, 6251836. Fax: 91-22-6204121.

Products: Chemicals

HITASHI CHEMICALS

11 Ezra St., Calcutta 700 001. Tel: 2479541, 2471759. Fax: 033-2479738/407173

Products: Aromatics, Chemicals, Natural Essential Oils, Perfumery Raw Material, Solvents, etc.

HOWRAH CHEMICAL WORKS

148 Mahatma Gandhi Road, Calcutta

WHOLESALE DEALERS & REPACKERS OF ALL DEHYDRATED FOODS & HERBS

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★ ALL TYPES OF ITALIAN HERBS ★ ALL TYPE OF MUSHROOMS

★ GARLIC POWDER/FLAKES/CHUNKS/GRANULES & OIL

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★ SPL. CHAT MASALA & ALL TYPES OF CONTINENTAL FOOD

ALL TYPE OF ITALIAN HERBS & GARLIC PRODUCTS



700007. Tel: 2383919, 2391051. Fax: 33-2382516

Products: Aromatic Chemicals, Antioxidants, Essential Oils, Emulsifiers, Guar Gum, G.M.S., Acids, Agar Agar, Chemicals, Flavours, Food Colours

HUBER CHEMICALS INDIA PVT. LTD.

103, Keshava, Bandra-Kurla Complex, Bandra (East), Bombay 400 051.

Products: Speciality Chemicals.

IDL CHEMICALS LTD.

P.B. No. 1, Sanathnagar (1E), P.O. Hyderabad 500 018.

Products: Pectin, Carrageenan, Locust Bean Gum, Ester Gums.

INDIAN GUM INDUSTRIES LTD.

51-A, Maker Chamber IV, Nariman Pt., Bombay 400 021. Tel: 022-2852075/76. Fax: 022-2040393. Tlx: 011-82139 IGUM

Products: "Stamulcol" Guar Gums & Hydrocolloid blends, Carrageenan, Pectin, Xanthan Gum.

INDO VANILLON CHEMICALS LTD.

245, Sector 17, Gurgaon, Haryana 122001. Tel: 0124-343246, 341976. Fax: 0124-343245

Products: Aromatic Chemicals, Ethyl Vanillin, Chemicals (Food), Essences, Flavours, Flavouring Emulsions.

INDUSMIN FOODS LTD.

H-10, Ninth Floor, Everest, Tardeo, Mumbai 400 034.

Products: Citrus, Pectin, Lemon, Oil, Natural Lemon Juice, Powder.

INVERT SUGAR (I) PVT. LTD.

U-112, Vidhata House, Vikas Marg, Shakarpur, Delhi 110092. Tel: 2200834, 2228834. Fax: 2227488

Products: Invert Sugar Syrup

J.K. MALT PRODUCTS PVT. LTD.

61 & 66 GIDC Estate, Nadiad 387001, Guj. Tel: 50474/50791/62289. Fax: 91-0268-51092

Products: Malt Extract

JAY CHEM MARKETING

5 Shanti Sadan, 2nd Fl., Kamla Nehru Cross Rd. 1, Kandivli (W), Bombay 400 067. Tel: (022) 8020141, 8061337. Fax: (022) 8061337.

Products: Monosodium Glutamate, Sorbic Acid, Pectin, Potassium Sorbate.

KAPADIA GUMCHEM INDUSTRIES

3 Mint Rd., Rm. No. 30, 2nd Fl., Opp. G.P.O., G.P.O. Box 1160, Tel: 2695073, 2659091. Gr: PHARMAGUM. Fax: 91-22-2619423.

Products: Gum Arabic, Guar Gum, Gum Karaya, Gum Acacia, Gum Carrageenan, Gum Tragacanth, Xanthan Gum, Citric Acid

KAYS SPICES & AGRO INDUSTRIES LTD.

P.O. Box 36, Mylapra Road, Pathanamthitta, Kerala. Tel/Fax: 91-473-322825.

Products: Curry Powders and Ground Spices.

KHUSHAL GENETICS

75 Kazi Syed Street, Masjid Bunder, Mumbai 400 009. Tel: 3438175, Fax: 4150010

Products: Asafoetida, Tamarind Paste, Spices, Herbal Extracts

KIRAN KOTAK & CO.

414/418 M.J. Phule Market, (Crawford Market), Bombay 400 001. Tel: 3429580, 3442796, Fax: 3429580.

Products: GMS, CMC, Sodium Alginate, Cocoa Powder, Gelatine Powder, Milk Powder, Citric Acid, Agar Agar, Pectin, Yeast, Ajinomoto.

KOTHARI FERMENTATION & BIOCHEM LTD.

16, Community Centre, 1st Fl., Saket New Delhi 110017. Tel: 6963167, 6850004. Tlx: 031-73202 MLK IN. Fax: 011-6850003

Products: Yeast (Fresh, Instant, Active, Inactive) Distiller's Dried Yeast, Distiller's Yeast Improver, Yeast Antolyzate Extract Paste & Powder.

KULU AROMATICS

Shamshi 175126, Kulu, H.P. Cable: AROMATICS. Tel: 91-1902-65179. Fax: 91-1902-22720

Products: Essential Oils, Vegetable Oils, Wheat Germ Oil, Herbal Extracts, Baby Corn (canned), Dried Mushroom Morels, Hops, Oleoresins, Spice Oils & Oleoresins.

KUSHALCHAND SONS

Devkaran Mansion, Block No. 1, 2nd Fl., 79 Princess St., Bombay 400 002. Tel: 2080937, 2052190. Fax: 2084265.

Products: Pectins, Carrageenan, Gelatine, Locust Bean Gum, Xanthan Gum, Coagulating Enzymes.

L.B. AROMA & CHEMICALS PVT. LTD.

4 Omex Chambers, Ground Flr., Rajeshri Shahu Marg, Andheri (E), Bombay 400 069. Tel: 8326277, Tel/Fax: 91-22-8354176.

Products: Essences, Essential Oils, Spice Oils, Oleoresins, Natural Food Colours.

LAKH ENTERPRISES

182 Yusuf Mehrelli Rd., 1st Fl., Bombay 400 003. Tel: 3756498, 3720957. Fax: 91-22-3755561. Tlx: 011-75096 PCOE IN

Products: Baking Powder, Cocoa, Ajinomoto, Custard Powder, Jelly Crystals, Agar Agar (China Grass), Cornflour, Caramel Puddings, Icing Sugar, etc.

LIBERTY CHEMICAL WORKS

Mogra Road, Off Nagardas Road, Andheri (E), Bombay 400 069. Tel: 8326420/8206480. Fax: 6121892

Products: Preservatives, Fine Chemicals.

MAHARASHTRA ESSENCE & GAS SUPPLIERS

24 Sarang St., Khokha Bazar, Bombay 400 003. Tel: 91-22-3422136, 3764252

Products: Essences, Essential Oils, Food Colours, Saccharin, CO₂ Gas, Crown Corks, Aerated Water, Bakery, Confectionery, Icecream and Candy Requisites

MAHENDRA CO.

1st Fl., Amar Chambers, 97 Kazi Syed St., Bombay 400 003. Tel: 3425832, 3428374

Products: Chemicals, Ammonium Bicarbonate, food grade Citric Acid.

MANISH CHEMICALS

106, Bhandari St., Maskai Bldg., 2nd Fl., R.No. 24, Bombay 400 003. Tel: 3400296, 3411302

Products: Citric Acid, G.M.S., Calcium Propionate, Milk Powder, Cream of Tartar, Cocoa Powder, Gelatine Powder, Ajinomoto, Tartaric Acid, Peppermint Oil, Stearic Acid, Sodium Benzoate, Saccharine.

MANORANJAN INDUSTRIES

12/B Thakurpalli Road, Agartalla - 799001. Tel: 0381-22-6325, 4932

Products: Ginger Oil, Ginger Spices, Dehydrated Ginger.

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Methyl Cedryl Ketone (China)
Maltol
Nutmeg Oil (Imported)
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Products: Food Colours

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Gopal Nivas, 1st Fl., 133 Princess St., Bombay 400 002. Tel: 2031798, 2084579. Fax: 2000951

Products: Flavouring Essences, Food Colours

RUPANDE FOOD PRODUCTS

52, Shivajinagar, N.M. Joshi Marg, Lower Parel (E), Bombay 400 013. Tel: 3060357.

Products: Dehydrated Herbs, Onion Flakes/Powder/Granules, Garlic Powder/Flakes/Chunks/Granules, White/Black Pepper Powder, Mushroom.

S.A. CHEMICALS

4/33, Malad Co-Op. Soc. Ltd., Poddar Park, Malad (E), Mumbai 400 097. Tel: 022-8839590, 8836417. Fax: 022-8835347.

Products: Maltodextrin Powder, Di-Calcium Phosphate, Pre-gelatinised Starch, Dextrose, Beta Cyclodextrins, Sorbitol, Lactose, Hydroxy-Propylated Starch, Carboxy Methyl Starch, Maltitol Xylitol, Caramel, Vit 'C' (Plain/Coated).

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Salem 636302 (TN) Tel: 447673/448046. Tlx: 450272 SAGO IN Gr: SAGOSERVE. Fax: 0427-445028.

Products: Tapioca Starch, Sago

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IN. Fax: 022-3420832.

Products: Ajinomoto, BHA, BHT, Cocoa Powder/Butter, Covering Chocolate Milk/Plain, Citric Acid, Calcium Propionate, Ethyl Vanillin, Gelatine, Lemon Oil, Milk Powder (Skimmed), Monocalcium Phosphate, Orange Oil, Pectin, Propylene Glycol, Soya Lecithin, Sorbitol, Sodium Alginate, Sodium Metabisulphite, Sodium Benzoate, Stearic Acid, Sodium Saccharin, Vanillin, Food Chemicals.

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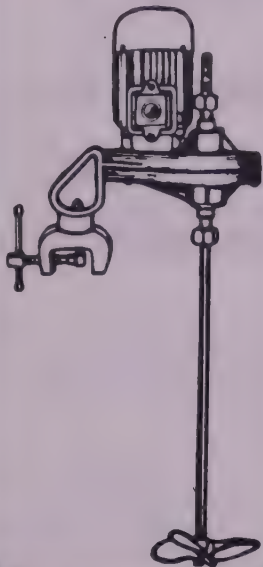
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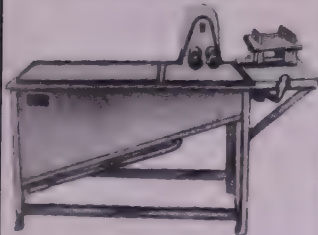
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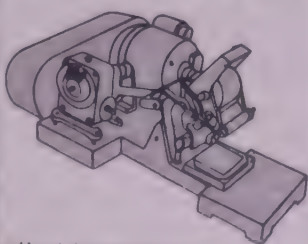
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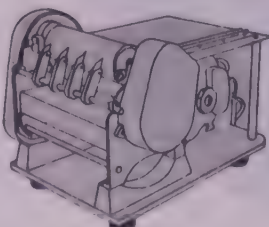
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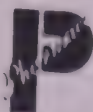
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NEWS & NOTES

INDIAN FOOD PROCESSING SECTOR NEEDS TECH UPGRADATION

Indian food processing equipment industry needs a major technology upgradation and a larger exposure to explore the \$30 billion European Union market.

These, however, are also necessary to tap the growing potential in domestic market, said the Managing Director of German Agricultural Society, Egbert U Conze had said the Anuga Food-Tec, the five-day international food technology fair, to be held from November 5-9 this year, will give the entrepreneurs a common platform to interact with each other and enhance their trade ties.

The fair is being organised jointly by KolnMesse and Germany Agricultural Society (DLG).

Egbert Conze and Elisabeth Nurnberger, a delegate from KolnMesse, are here to invite representations from the Indian industry to participate in the fair.

Awareness of industry across the border, including its demand supply relationship, existing trends and opportunities are the essential features for evaluation to influence growth of the sector and alliance between companies, said Nurnberger.

Present at the conference, organised by the Indo-German Chamber of Commerce and Industries (ICCI), was KC Damodaran, Deputy Secretary of the Chamber, who said by participating in the fair, the Indian manufacturers can learn and coordinate with European companies and they will also be able to boost their trade ties with several developing countries participating in the fair.

Conze said that the rapid integration of the European Union and growing food industry there offers tremendous opportunities to entrepreneurs.

Enormous cost pressures, investments and demand for large scale production can specifically work in favour of Indian and other development countries, which have the advantage of cheap labour and raw material.

However, "plans to export food commodities to the US or Europe will require a sound knowledge of the strict international standards and food legislation which means re-engineering and adapting better technical processes," said Conze.

As per the latest information 760 companies from all over the world have confirmed their entry into the trade show, said Nurnberger. Countries known for their advanced food technology, such as Italy, US France, Switzerland and Netherland will be prominently represented in the fair, she informed adding that more than 3.5 per cent of the entries are from outside Germany.

The fair will be attended by various related industries like manufacturing industry, process technology and packaging.


Besides these major industries representation is also confirmed from areas such as production and hygiene and logis-

tics, industry waste management, utility provision (energy, water, air), data processing freezing technology and quality control.

The trade show is also likely to include seminars on several issues related to the industries problems and prospects, said Conze, adding that issues like ISO-standards and certificates are the common features in the food production process.

MOLASSES GLUT SWEETENS LIFE FOR ALCOHOL - BASED CHEMICAL INDUSTRY

The crash in the prices of cane molasses has placed producers of alcohol-based chemicals in a position of strength from which to argue for price fixation by the Centre. While they are confidently expecting to cart away free molasses from sugar factories soon, chemical producers may actually be willing to negotiate a higher



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price for molasses raw material with the government, as long as it precludes fluctuations.

The molasses glut has given a lease of life to companies such as SM Dyechem, and is allowing producers to compete on price of chemicals such as acetic acid and derivatives.

The glut of sugar and molasses in the state has meant that prices of molasses have gone down from Rs. 800 per tonne at the beginning of the sugar season to the current level of Rs. 50.

Accordingly, prices of chemicals derived from alcohol have dropped over the four-month period.

Decontrol was seen in the chemicals industry as a political decision taken essentially to appease a strong sugar lobby, now the surplus has ironically enabled the industry to make comfortable profits and at the same time appear magnanimous in offering to settle for a higher price.

The price of molasses when it was decontrolled in June 1993 was Rs. 144 a tonne, and producers of alcohol-based chemicals say that they will be mentally prepared to accept this as a price now.

While molasses prices are not likely to rise in the near future, the industry shudders at the memory of the Rs. 1,500 a tonne figure reached immediately after decontrol. The thrust of the industry's argument for fixed prices is that molasses, being a feedstock for downstream chemicals, should be treated on par with other feedstocks such as naphtha which have administered prices.

The alcohol-based, chemical industry competes directly with the petrochemical industry in producing chemicals like ethylene, monoethylene glycol (MEG), butanol, and acetic acid. An increase in input costs thus hits the industry hard.

The glut in molasses may also have a genesis in a lower than predicted offtake by potable alcohol, according to industry sources. Some liquor manufacturers are converting to grain alcohol, and chemical producers feel that the 30 per cent of molasses that was sought to be set aside for potable alcohol may be an overestimate.

Mr. S M Shetty, promoter of the SM group, feels that prices in the off season will touch more realistic figures of around Rs. 200 a tonne. He does not foresee a need for a reinstatement of controls: "We suffered for three years — now let us benefit."

In fact, a glut in molasses is likely to lead to storage and environment problems. Sugar factories are already offering generous credit terms, being prepared to pay the 20 per cent excise duty immediately along with 19 per cent sales tax. This translates to a payout of 2 per cent for the alcohol-based chemical industries as they get a set off of 17 per cent on the sales tax, with the entire excise duty, which can be cleared in six months being modifiable.

Mr. P M Kavaria, managing director of Somaiya Organics, says that the price drop to Rs. 50 is 'illusory' and that it would not be possible to cut prices of downstream chemicals further.

BIO-ENGINEERED MILK INCREASES RISK OF CANCER

Milk produced by cows injected with a production-stimulating hormone increases the risk of breast and colon cancer in humans, two U.S. consumer groups have warned, according to DPA.

The 'cancer prevention coalition' (CPC) and Vermont-based 'food and water' said recently the danger lies in IGF-1, an insulin-like growth factor in milk, which is increased in cows injected with recombinant bovine growth hormone (RBGH), which was approved for use by the U.S. Government in late 1993.

Covering lines of evidence incriminate IGF-1 in RBGH milk as a potential risk factor in both breast and gastrointestinal cancers, said Samuel Epstein, author of a study on RBGH milk.

IGF-1, present in both cows and humans, is a powerful stimulator and regulator of cell growth and division.

U.S. AGENCY APPROVES FAT SUBSTITUTE FOR SNACKS

Federal regulators have approved a controversial fat substitute for use in snack foods but required food makers to include warnings that olestra may cause side effects such as cramps, reports Reuter.

The food and drug administration also said that because of its unique chemical composition, olestra adds no fat or calories

to food, and the agency approved its use in potato chips, crackers, tortilla chips and other snacks.

The agency said available data established that olestra was safe for use in those snack foods, which account for about \$4 billion of the estimated \$15 billion Americans spend on snack foods each year.

But some people may experience side effects from olestra, which is manufactured from sugar and vegetable oil

GOOD BUSINESS THROUGH OVERSEAS FAIRS

The Spices Board will be participating in major food fairs in different parts of the world during the current financial year. The fairs have been selected taking into account the importance of the markets. As a matter of policy, participation of the exporters is being encouraged for fruitful results. From experience it has been noticed that trade fairs offer maximum benefits. In the past, participants were able to introduce their companies and products to the very serious business visitors from different spice buying companies of the world. Many of the Indian exporters were able to bag sizeable orders also.

This year also the Board is expecting good response from the registered exporters of the Board in these fairs.

ISO CERTIFICATION

Bureau Veritas Quality International (BVQI), the London-based agency authorised to award ISO certification, conducted a three-day audit of Packaging factory and Marketing Division at Powai. They later announced that the team of three auditors had unanimously decided to recommend Larsen & Toubro Packaging for the ISO 9002 certification.

CANS OF THE YEAR

At Cannex'96 in Maastricht, Divecha Glass Industries of Bombay has received commendation Certificate for their entry at the 'Can of the Year' competition for the highest standard of their cans.

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COMPANY NEWS

ENKAY

Having tasted the fruit of success in the international market, Enkay Texfoods Industries, the Rs. 200 crore company engaged primarily in the business of exports of fruits and texturised yarns, is all set to enter the domestic fresh fruit juice market. The company will introduce its 100 per cent fresh fruit juice products by October in the Indian market. However, it has not yet been finalised whether the products will be launched in bottle-form or in tetra packs.

The first products to hit the market will be a multi-fruit juice. While multi or mixed fruit juice constitutes around half of the overseas fresh fruit juice market, it has not been introduced in India as yet.

Enkay's new product is expected to be a mix of pineapple, orange, mango, guava and banana juices, sources said, adding that the company's investment in the venture is anticipated to be around Rs. 10 crore.

Currently, the company is in the process of finalising the logistics of the launch, including the quantity of production, advertising and marketing budget and even finalising the title of the brand.

The new product will be produced at the company's existing plant located near Vapi in Gujarat. The plant, one of the largest in Asia, was set up by Enkay in collaboration with the Thyssen group, the third largest corporate house in Germany.

Incidentally, Enkay also is the first com-

pany in the Asian continent to produce banana puree. According to sources, the company is also planning to invest another Rs. 100 crore in setting up a food processing plant.

"The new plant will come up near Bangalore but will be located in Tamil Nadu," said the sources adding that the company would soon shortlist technical suppliers for the new plant.

VINTAGE FOODS

Vintage Foods and Industries Ltd, engaged in the manufacture of milk products, proposes to establish a fullfledged integrated dairy complex with an installed capacity of 175,000 litres of milk per day to produce about 10 tonne of cheese. The cost has been estimated at Rs. 1350 lakh.

BHANDARI FOODS

Bhandari Food Flavours Ltd. has plans to set up a processing sector to produce coconut byproducts for domestic consumption at a cost of Rs. 7.3 crore. The unit, which is expected to start commercial production by March 1997, will manufacture 2,304 tonnes per annum of coconut cream, 1,500 tonnes of coconut water, 1,170 tonnes of coconut oil and 1,200 tonnes of coconut dessicated powder. The technology and the machinery needed will be supplied by Sangram Engineering Ltd. a Pune-based company. The company's product, coconut water will be marketed for the first time in

bottles as well as in tetrapacks of 250 ml size and will be priced at Rs. five per pack.

GPP BEVERAGES /CRYSIND

GPP Beverages and Foods Ltd. a 100 per cent export-oriented unit producing Golden Valley brand mineral water, has been taken over by Crysind Electronics (Pvt.) Ltd under a negotiated settlement with the present promoter and financial institutions, according to a spokesman of GPP.

The GPP Beverages which has its natural mineral water plant at Kallar, near Thiruvananthapuram, launched the Golden Valley Mineral water over four years ago. Despite marketing arrangement with Godrej Foods Ltd, the budget sales could not be achieved.

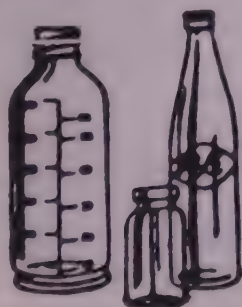
The company had to resort to direct marketing after Godrej withdrew from the arrangement in February 1995. Even this did not bring in the desired result and in 1993-94, GPP incurred a loss of Rs. 27.5 lakh which rose to 73.89 lakh loss by 1994-95.

Now the takeover by Crysind Electronics follows a revival package lately worked out between the present promoter, Kerala State Industrial Development Corporation (KSIDC), Central Bank of India, Kerala State Financial Corporation etc.

A spokesman of the Crysind Electronics said that in addition to reviving the ailing unit at Kallar, the new management would

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introduce more products like flavoured mineral water, aerated water and spice food items.

PALS DISTILLERIES

Pals Distilleries Ltd., a sister concern of Mysore Breweries Ltd. is planning to set up a new project for the manufacture of beer at Aurangabad in Maharashtra. The proposed brewery will have an installed capacity of 10,000 kilolitres per annum. The cost of the project will be Rs. 17.50 crore.

According to an official statement the company has acquired land in MIDC industrial area at Aurangabad and the site development has been completed. The construction of the building has commenced during November 1995. Pals distilleries has placed orders with Alfa Laval India Ltd. for supplying plant and machinery on a turnkey basis.

The state of Maharashtra where the plant is located has the highest beer consumption in the country. The company products are sold under the popular brand names like Knock Out, Pals and they have also entered into an MOU with Mysore Breweries for using their brand name and trade marks.

The future demands for beers in the country is expected to rise at a rate of 10 per cent per annum.

COCA-COLA INDIA

Limca, India's top selling cloudy lemon carbonated soft drink, has been launched in cans. The new packaging will add dynamism to the 25-year-old brand while broadening the appeal of the brand to include a larger segment of younger consumers.

Coca-Cola India said the new packaging will also enhance Limca's visibility and preference and enable the brand to capture the growing segment of consumers seeking convenience packaging.

The Limca cans have been introduced with attractive new, three-colour brush-stroke graphics that are more modern interpretation of the traditional Limca graphics. The brush-stroke graphics have been developed exclusively for the convenience packages of Limca and adapt and expand the basic Limca logo to this new package, the company said.

In a bid to increase its strong hold over bottlers, Coca-Cola India has offered to

pick up a majority shareholding in over a dozen of its 53 franchisees in the country.

The company is believed to have approached its bottlers in Rajasthan, Punjab, West Bengal, Uttar Pradesh and Delhi. When contacted Coca-Cola India did not comment on the offer and said: "All business discussions with our partners are confidential and therefore it is inappropriate for us to comment upon".

The offer comes at a time when the bottlers are being asked by the company to upgrade their plants and expand capacities.

This would require a fresh investment, which many franchisees might not be willing to undertake. The offer is part of its strategy to get directly involved in the bottling operations in the country. The move comes in the wake of the multinational's application to the government seeking approval to invest an additional \$700 million in the country.

The company intends to invest in its own bottling plants and has sought permission from the Foreign Investment Promotion Board to set up two subsidiaries which would own its bottling units. The proposal is yet to be cleared by the cabinet committee on foreign investment.

The company wants to invest in bottling units so that the production capacity in the country keeps pace with its market targets.

MCDOWELL & CO

McDowell and Co Ltd., the flagship company of the UB Group, has been restructured following the financial merger of Carew Phipson Ltd and Consolidated Distilleries with McDowell and Co. Ltd.

The offices of these three companies have also been relocated in one place in different towns, a release issued on behalf of the UB group said.

Effectively, the product portfolio of the three marketing outfits is being merged in such a manner that henceforth there will be two divisions. The two resultant outfits after the reorganisation will be known as McDowell team I (M-I) and McDowell team II (M-II).

M-I, which will be headed by V.K. Luther, will essentially have original McDowell brands with 'Forbes Dry Gin' and 'Two-in-One' added to their portfolio.

M-II on the other hand, will be headed by Ashwin Malik and have the original portfolio of Carew Phipson Ltd and

Consolidated Distilleries Ltd. It will, in addition also handle "Signature Whisky" and "Vintage Classic Whisky", from July 1st.

The above reorganisation will produce a balanced product portfolio under M-I and M-II and will enable these two teams, under McDowell and Co Ltd to be more competitive and effective in the market place. Both the teams will manage 13 brands of whisky, gin, rum, vodka, brandy and campari.

UNITED BREWERIES

United Breweries (UB), has launched their second best-selling beer brand Kalyani Export Lager, in the UK.

Kalyani is already a proven success in the home market as the third largest selling beer and the leader in the premium segment.

The earlier success of the market leader Kingfisher, in the international market has encouraged UB to launch Kalyani Export Lager in the UK.

With the booming Indian restaurant scene in the UK, the new premium lager is sure to find an instant niche market. UBSN, the joint venture between United Breweries and Sheperd Neame of Kent, will move Kalyani into the UK through the established Kingfisher distribution channels.

NESTLE INDIA

Having met with an encouraging response to the Kit Kat chocolate launch, Nestle India Limited is expanding its manufacturing capacity at its plant at Ponda in Goa.

Subsequent to its good annual results this year, Nestle has launched Milo, the world's largest selling chocolate energy food drink, in May. Milo is being manufactured at the Nanjangud plant in Karnataka. The company has also undertaken expansion of its Nanjangud plant to double instant coffee manufacturing capacity.

Consequent to extremely buoyant sales, Nestle is setting up a factory at Bicholim, Goa, for the manufacture of a range of culinary products. It has commissioned a new plant to manufacture instant noodles at Samalkha in Haryana.

The performance of new products launched over the past two years is very satisfactory, particularly in — Bonus (soya based health beverage), Polo, Mint, Milkmaid dessert mixes and Contadina snack

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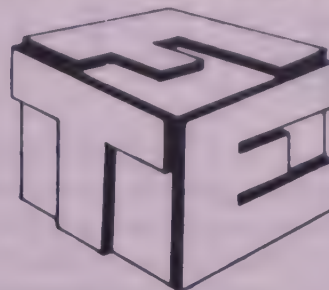


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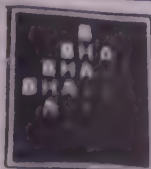
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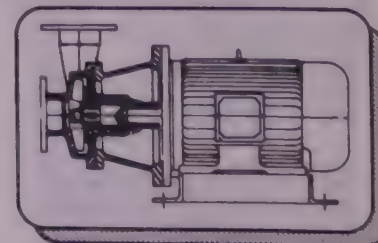
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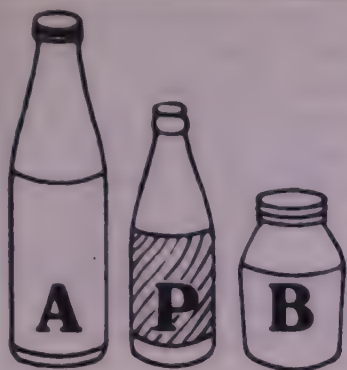
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dressing.

The turnover of the company has crossed the Rs 1,000-crore mark this year, as against last year's figure of Rs 716 crore. Nestle India Limited has registered a 40 per cent increase in net sale according to its financial results for the year-ended December 31, 1995 over the corresponding period last year.

UDIL

United Distiller of the Guinness Plc, is all set to launch two new brands in the Indian market. Its scotch brand 'White Horse' and the largest selling international gin, Gordon's are expected to hit the shelves within the next two months.

White Horse is aimed at completing the price spectrum in the Scotch whisky segment.

PEPSICO INDIA

PepsiCo India Holding, one of the largest contributors of foreign direct investment in India, proposes to put up a mango juice plant in West Bengal.

The beverages and foods giant plans to inject nearly 10 per cent of its total investment proposal of Rs. 700 crore country-wide into West Bengal during the current financial year. The investment will be geared to cater to a demand size of around Rs 150 crore in the state.

With two bottling plants, PepsiCo is confident of capturing about 30 per cent of the market share in the state.

The company which took over the SK Birla owned Sunrise Products, having accumulated losses of more than Rs. 8 crore, in 1994, has already poured Rs. 18 crore into this Panagarh plant. The capacity of

the unit has been trebled to 600 bottles per minute.

The wholly owned Indian subsidiary of the soft drinks major will be marketing the mango juice under the brand name 'Slice'. The Rs 70-crore investment includes the establishment of the mango juice line as part of the carbonated soft drinks bottling unit near Calcutta.

PepsiCo India Holding will invest Rs. 5 crore into the mango juice line of 120 bottles per minute and around Rs. 30 crore for the production of 600 bottle per minute od Pepsi Cola.

NIRULAS

In an attempt to popularise its products, the fast-food chain, Nirulas has decided to market its items through hotels, restaurants and large institutional buyers.

The food items which would be manufactured and marketed included ice-cream and frozen desserts, sorbets, bread, cheese, tomato and chilli sauce, mustard, mango and strawberry condiments. Most of these are hitherto being sold at Nirulas outlets.

Disclosing this, Samir Kuckreja technical advisor, Nirulas Corner House Limited the flagship of the group said that "the next phase is to extend the marketing of these food items to exclusive retail outlets".

Nirulas is capitalising on the potential in the food processing sector, and would be competing with big players like Nestle and Brooke Bond Lipton India Limited (BBIL).

The marketing of sauce and condiment would be done in jars and satchets. Nirulas would not insist on its brand name being used while marketing these products. Kuckreja stated. Seeing the boom in the

home delivery outlets, Nirulas has also decided to concentrate on this segment, by extending it to 10 outlets in Delhi. Though it had started home delivery in 1994, it has been a low-key affair till now.

Besides expanding its existing production facilities at various outlets, including the Noida Nirula, two 'Nirula Expresses'—one each in south and in the outskirts of Delhi would be opened. Nirula Express, which is the smallest outlet of the chain, around 550 sq feet, has been opened at Vasant Kunj in south Delhi.

Kuckreja added that Nirulas has drawn up plans to open three to four large restaurants in Delhi — in the north and west — by the end of this year. This is in keeping with the restaurant's goal to set up four units a year.

Despite the fact that large foreign chains like McDonalds, Dominoes, Pizza Hut, are setting up shop in India, Nirulas would continue to go it alone. Nirulas would not be entering into franchise or a joint venture for this purpose, Kuckreja elaborated. Moreover, Nirulas is tying up plans to set up three star hotels of 50-100 rooms in five cities — Lucknow, Ludhiana, Jaipur, Chandigarh and Agra. For this purpose, it would be entering into joint ventures with the local parties.

PARLE AGRO

Joly Jely is the new product from Prakash Chauhan's Parle Agro, a company that won with Frooti but did not do well with Pingo and Appy. "The aim is to try and do something unique, give the Indian consumer a taste which is entirely new and thus create a market through innovation," says a spokesperson for Parle Agro. Joly Jely will come in two flavours, a mass-oriented orange tang and a little more upmarket

strawberry. Backing the product will be convenient packaging. A whole new plant has been set up at Patalganga with technology from Tetra Pak.

Says Mr Dharmesh Sodha, group product manager for Parle Agro, "The taste trials are quite positive. Out of a sample survey of 2,000 respondents, 89 per cent said that they will buy the product and almost 21 per cent have told us they like it better than any other in the market."

The company is aware it is a new concept. But considering the fact that it is quite popular in Europe and is expected to give the consumer a wobbly jelly feeling as he sips the drinks, the company hopes it hits paydirt in the Indian mass market.

Unlike Appy and Pingo, which are now at best niche market products, Parle Agro is positioning Joly Joly as a national product on the lines of Frooti and mineral water brand Bailey. Much hopes are being pinned on the product. And, Parle Agro hopes that a combination of Frooti and Joly Joly will considerably enhance its growth prospects from the 33 per cent it achieved last year.

For distribution, the company will depend on its network of retailers, with whom strong relationship have been built through Bailey and Frooti.

Further, Parle Agro is tying up with Husky Injection Moulding System and Sidel of France to set up a Rs. 50-crore PET bottle venture for Bailey, its Rs. 200-crore mineral water brand. This would make Parle the first company in India to sell mineral water in PET bottles. So far, mineral water is only sold in PVC bottles in the country.

The Husky-Sidel technology will mean bringing in Husky's preform making machine and Sidel's stretch blow moulding machines. Parle will locate the 100-million preform making machines in Silvassa and the blowing machines in various centres across the country. The facilities will be ready by July this year.

Confirming this, Parle Agro general manager R Ravishankar said that the basic rationale was to upgrade the product, go in for sophisticated packaging and bring in international standards. PET bottle would increase the cost of the product only marginally, he said. In addition, the consumer would get unbreakable bottles with very good clarity, he said.

According to Mr. Ravishankar, Bailey is the fastest growing mineral water brand in the country. Bailey was launched three

years ago and operates today out of 22 franchise locations. The brand grew some 180 per cent over calendar 1994, he said. Bailey sells around 25 million bottles annually with a market share of over 30 per cent.

The blowing machines will be located in Mumbai to start with and will then move on to Delhi, Calcutta, Bhopal, Cuddalore, Hyderabad and Goa before moving on to other centres in the country.

ADITYA FLOUR MILLS

Aditya Flour Mills, which took over a flour mill from the Gloaka Group in Bokaro is planning to come out with products like sooji, maida and atta in packets. All these are the products of the same mill.

Dilip Jain, Director, Aditya Flour Mills said, "We took over this mill in 1994 and by May of this year production will be in full flow." The mill was renovated and modernised for a cost of Rs. 15 lakh. It has two plants — A and B. The second will producing atta only, while the first one, all the three.

However, at present the company is marketing all these products in sacks but later on it will be replaced by the packets. Of the total market of this sector, "The unorganised sector is the majority with a share of 80 per cent," said Jain.

"The total capacity of our mill will be 225 metric tonne a day of which only 30 per cent will be utilised at the moment. We are waiting for the government clearances for the trade mark and I think it will be in our hands within the next 45 days," said Jain.

The total cost of the project will be something around Rs. seven crore. The turn-over of Aditya Flour Mills, before this new project was Rs. 15 crore and by May 1997, Jain expects it will be something around Rs 40 crore.

GOKUL AGRO

Gokul Agro Industries, a Gujarat-based manufacturer of chilly, turmeric and other masala powders has an existing capacity to manufacture 510 tonnes of masala powders which are marketed under the brand name, 'Gokul'. With an aim to tap export markets, the company is now planning to increase its capacity.

The company is planning to incorporate automated machines for grinding and is increasing its capacity six-fold to 3240 tonnes. The project has received good support from Gujarat State Financial Corpo-

ration, who is playing the dual role of co-manager to the company public issue and an institutional financier for the project. As appraised by GSFC, the project is estimated to cost Rs. 5.7 crore. But nearly 40 per cent of the issue proceeds will go as margin money.

The project is expected to be commissioned by July and the full impact of the project on the company's performance will be felt in 1997-98.

Gokul Agro has a significant presence in the masala manufacturing industry. The powder making process is not a value-added one and is largely labour-oriented. The branded masala industry has had to incur a lot of marketing costs to create strong brand equity. Some of these are Badshah Masala, Ashok Masala, Madhur Foods etc. It is these strong brands against which the Gokul brand will be competing.

An average consumer procures these masalas only in small packets. The price of branded masala powders have not shown any real improvement in the past few years and this is largely due to stiff competition among the various brands. The per unit realisation on masala powders is quite low, eg. a 250 gms packet of chilli powder of Gokul Agro will depend largely on volume sales.

For the first eight months of 1995-96, Gokul Agro has achieved a net profit of Rs. 18.6 lakh on sales of Rs. 1.59 crore. The current OPM is 14 per cent, but the company expects it to come down to 12 per cent in the next few years. However, not much improvement is expected in the masala prices.

The future growth of Gokul Agro will depend on volume sales it can generate both in domestic and exports.

TATA TEA

Having put behind rumours about any kind of alliance with the Hindustan Levers group, Tata Tea is back on an acquisition binge.

The company has recently acquired a small garden, Konikar Dalim based in Jorhat. The garden was owned by the Calcutta-based company Sheo Prasad Surendra Kumar Pvt. Ltd. The family which also owns another estate, Baishabi is believed to have sold off Konikar to the Tatas, after an internal asset restructure between the brothers.

Konikar, the latest acquisition of Tata Tea, follows the company's two other pur-

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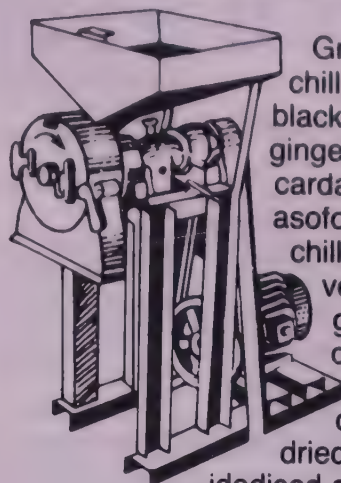
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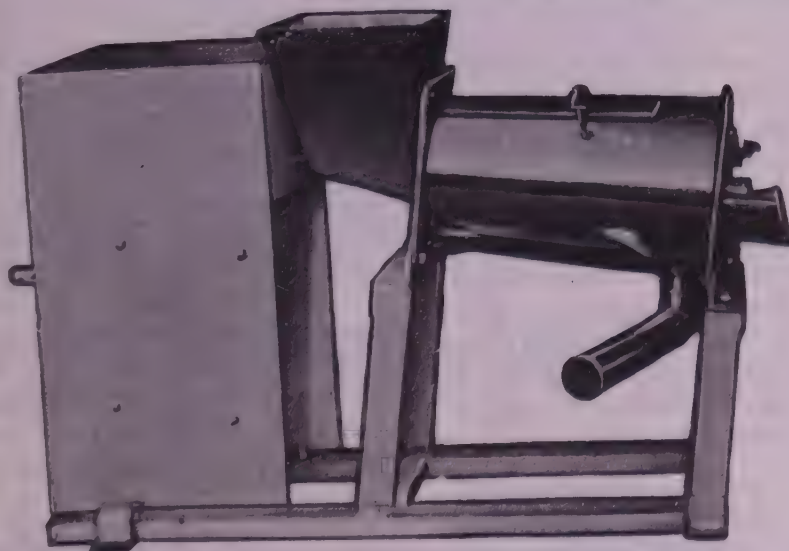
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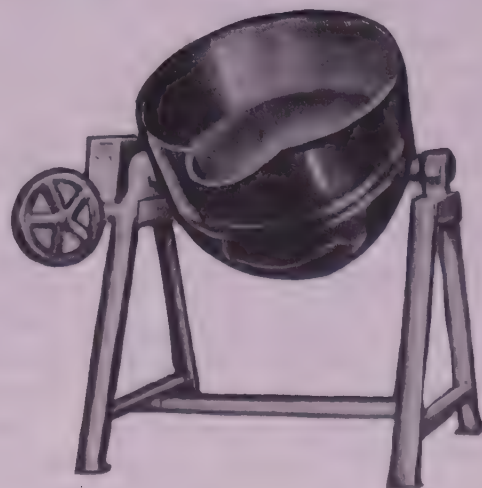
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chases last year, Borjan Tea Estate in Assam and Badabari Tea Estate in Dooars in West Bengal. While Borjan produces about 6.5 lakh kgs of green leaf, Badabari has a production capacity of seven lakh kgs.

Konikar Dallim will add another four lakh kgs to Tata Tea's overall production. The garden has an area of around 244 hectares. The garden is strategically located, being virtually an out-division of Tata Tea's Teok Tea estate.

Mr. R K Krishna Kumar, managing director of Tata Tea, while confirming its acquisition, said, this would help the company to increase the production of tea from Teok. Since Konikar Dallim does not have any tea factory, the entire green leaf production would be transported to Teok for tea production. Teok, at present, manufactures around 5.5 to six lakh kgs, and is also undertaking an expansion. The Konikar acquisition would add to Teok's production substantially, Mr. Krishna Kumar said.

About the cost of acquisition, Mr Krishna Kumar said that the company has paid a price of about Rs. 105 per kg. Considering the fact that Konikar Dallim produced about four lakh kgs, the price is a little over Rs. four crore. For Borjan acquired last year, Tata Tea paid a price of Rs. 110 per kg of tea.

The recent acquisition in India and in Sri Lanka, where Tata Tea took over the Watawala Tea Estate, along with certain capacity expansion planned, will increase the total tea production to around 62 million kgs in the current year.

Besides Watawala, Tata Tea also manages another large property in Sri Lanka, Kahawatta Estate. In Sri Lanka alone, the company has access to a production base of about 16 million, which includes purchase of about two million kgs. Watawala has a captive capacity of six million kgs. The entire tea production in Sri Lanka is exported from there, Mr Krishna Kumar said.

VADILAL DAIRY

In what it calls a major coup, Mumbai-based ice cream manufacturer Vadilal Dairy International Ltd., has absorbed 500 distributors who earlier were part of the Brooke Bond Lipton India Ltd., Kwality-Wall's cold chain.

The 500 distributors span across four states : Maharashtra, Karnataka, Andhra Pradesh and Goa. While a Vadilal spokesman claims that the company's increased strength will go a long way in help-

ing strengthen the distribution network for its ice creams, cheeses, spreads and milk, BBLIL remains unperturbed by the development.

According to a company spokesman, BBLIL's efforts at building a world-class cold chain have led it "to scrutinise the strengths and potential of each of our distributors... and we have retained only those who had the competence and capability that we require to deliver the best value to our consumers".

UB CARLSBERG

Beer guzzlers are in for cheery days ahead. Bangalore-based United Breweries tie-up with Germany beer manufacturer Carlsberg that has been in the offing for long, has finally received official sanction.

Under the terms of the agreement, Carlsberg beer will be manufactured at one of UB's existing plants. However, plans for a 1996 summer launch may not come through since some of the machinery required for the plants has yet to be imported.

SM FOODS

In a major re-orientation move, the Rs. 400 crore SM Dyechem group has decided to accord priority to its five year old food division. The group is all set to launch a host of new products in the coming months.

The food division of the company, SM Foods, which currently markets 'Peppy', 'Piknik', 'Minerale' water and the 'Vital' brand of refined soyabean oil also harbour plans to launch at least 4 to 6 new products every year.

"We are expecting 100 per cent growth in the next three years", said PK Gokhale, head food division, SM Dyechem. He added that a new product management cell has been incorporated at SM Foods with a view to give thrust to the new strategy of the company of turning the food division into a star performer.

To begin with, the company will very shortly launch its 'Vital' brand of refined soyabean oil in the western region. "The launch of 'Vital' which has a strong presence in north India, is expected to make us the market leaders in the total refined oil sector in the country," he added.

As regard the snack section of the SM's food division, Gokhale said the company will be introducing atleast four new products in the markets in the next 2 to 3 months.

"Of the 900 different varieties of snacks available in India, we have shortlisted 8 kinds," he said. After test-marketing, SM

Foods will be shortlisting four products for the final launch.

To supplement the growth process for its snacks section and reduce the distribution cost, the company will be opting for the 'multiple-location sourcing' strategy.

To increase its combined sales from the current Rs. 150 crore, the company is also in the process of re-positioning some of its products while simultaneously sprucing up its brand through product-line extensions.

The company is also attempting to break into new audience by introducing new flavours for the adult consumer. The company's new flavours under its 'Peppy' brand namely the 'Ringos', 'Peppy' cheese balls and the 'Peppy' tomato 'n' spice have already been launched with the aim to attract the adult consumers.

PARRY CONFECTIONERY

Parry Confectionery Ltd (PCL), part of the Murugappa group, plans to bolster its market leadership in sugar confectionery business by floating two joint ventures with a total outlay of Rs. 20 crore.

The new ventures are meant to produce speciality confectionery items like lollipops, toffee and chocolates. They are expected to hit the market next year. The company has obtained the approval of Foreign Investment Promotion Board (FIPB) to team up with the Spanish major Chupa Chups for producing lollipops. PCL will pick up a 49 per cent stake in the new firm styled Chupa Chups Parry Ltd, leaving 51 per cent of the stake to the foreign partner.

Group sources said that this will be the first JV of PCL and it will benefit from the strength of Chupa in process technology and marketing and turn out exciting products. It will also mark the official entry of Chupa into the Indian market although the products are already available through illegal channels.

PCL is awaiting FIPB approval to float another JV with 50:50 equity participation to manufacture speciality confectionery items. Till it was cleared, the sources declined to divulge the name of the foreign partner. The group has a policy of funding JCs through internal accruals and raising funds from market and other sources for modernisation.

The funds are mainly meant to further modernise the Nellikuppam factory and bring the facility up to international standard. In the Rs 400-crore sugar confectionery business, PCL is a market leader with a 26 per cent market share. It is not perturbed by the entry of multinationals

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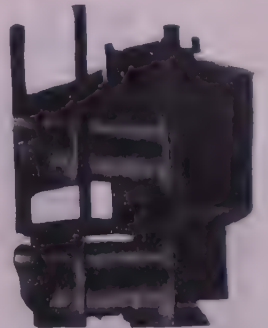
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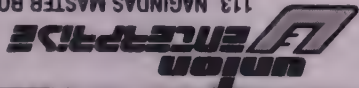
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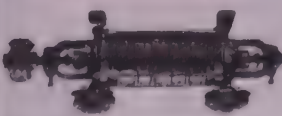
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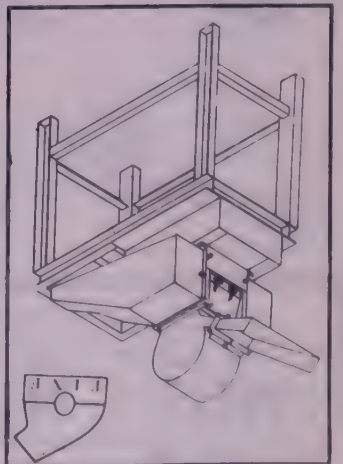
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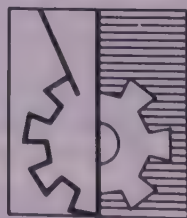


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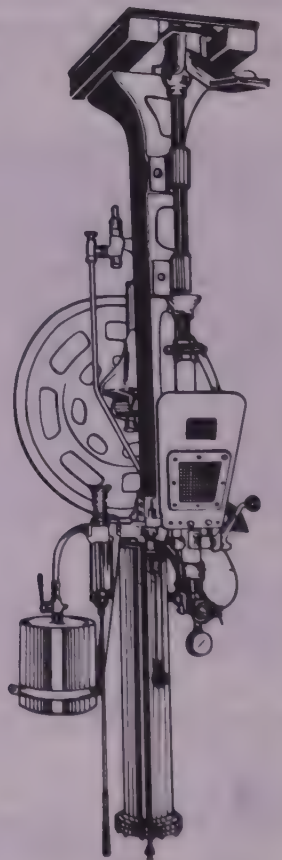
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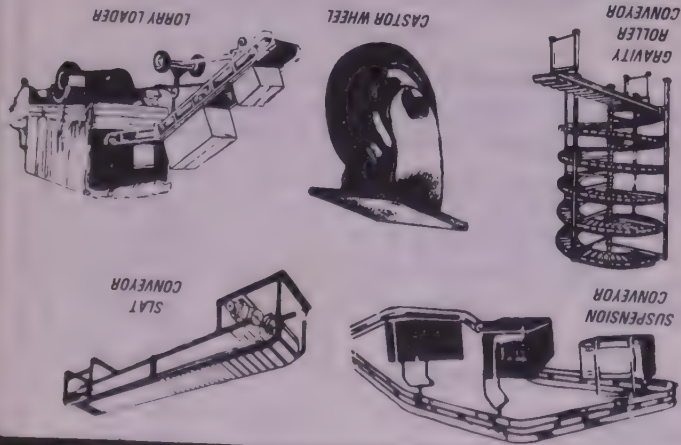
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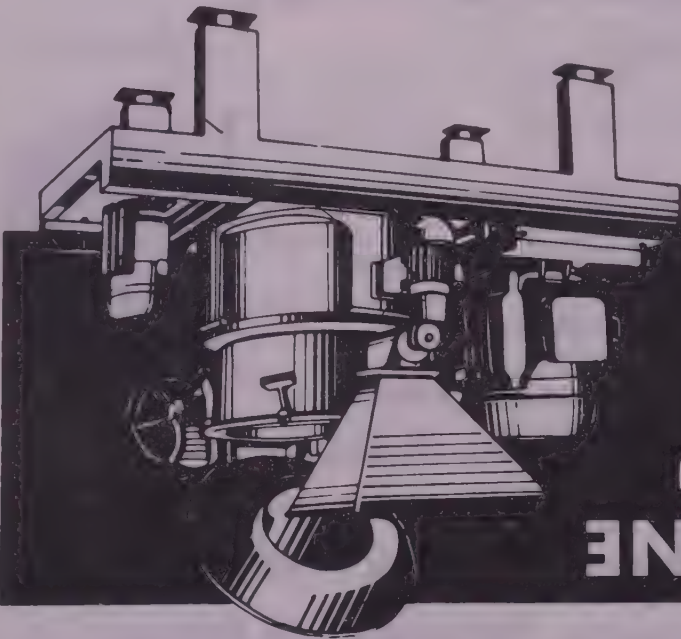


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WHEAT

The export earnings from spices for the first 11 months of the current fiscal year registered an increase of Rs. 101.55 crore when compared with the corresponding period last year. According to sources from the Spices Board, the exports of spices during April-February 1995-96 has been estimated at 164,255 tonnes valued at Rs. 632.75 crore as against 135,715 tonnes valued at Rs. 530.20 crore when compared with the corresponding period of the last fiscal year.

Export earnings from spices registered an increase of Rs. 31 crore during the month of February 1996 alone when compared with the corresponding period last year.

"Naturally India stands a good chance,"

SPICES

MEAT

The export of meat and livestock is likely to exceed Rs. 500 crore during the current financial year as against Rs. 448 crores for the previous year. Buffalo, sheep and goat meat are in demand in Malaysia, KCBT May wheat ended up the 25-cent-per-bushel daily limit at \$ 6.84 - 1/2 per bushel, surpassing all time high for a KCBT wheat contract of \$ 6.59 - 1/2.

Hard red winter wheat futures ended at a new all-time high at the Kansas City Board of Trade. Concerns about significant crop damage and a US agriculture department report rating 45 per cent of the crop in poor condition have fuelled the rally.

The export market had already improved, Tanna said. "In the last couple of days Indian wheat was being quoted at \$ 176/177 per tonne compared to \$ 172/173 earlier."

said Mulraj Tanna, a leading Mumbai foodgrains trader.

India has a livestock population of 430 million, but its share in the global meat market is small. This is due to poor livestock management and lack of mechanised slaughter houses in the country. There are just six modern mechanised slaughter houses, says Mohammed Wajid of Al Ahad Company.

The Central Government had allocated Rs. 19.75 crore for the "development of technology and infrastructure for export-oriented livestock product units", in the Eighth Plan.

Meat is a highly perishable commodity and has to be chilled at zero to two degree temperatures before being exported. Lack of chilling plants near the abattoirs makes this difficult.

Mechanisation of slaughter houses will improve meat abroad, says Ifran Qureshi of Al Shuja Exports and will boost the leather industry.

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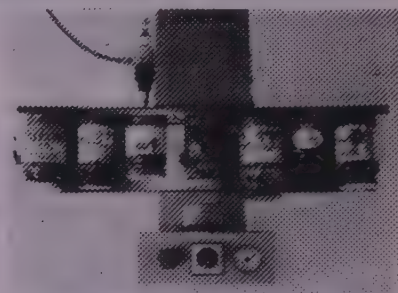
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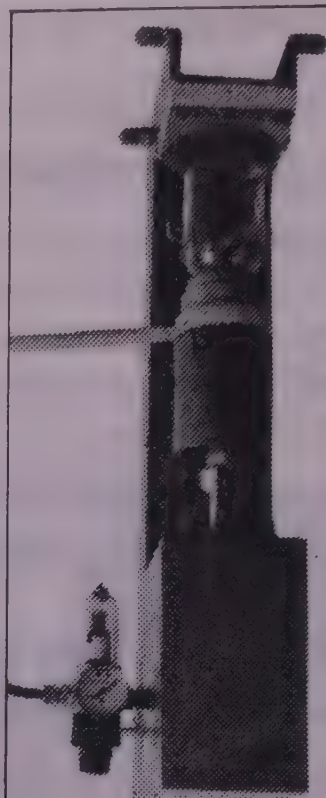
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TRADE FAIRS & EXHIBITIONS

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IEFP
Venue: San Francisco, California
Date: October 20-23 1996

Everything you need to process and package any kind of food or drink can be found at the 1996 International Exposition for Food Processors[®] (IEFP). At the Moscone Centre in San Francisco, California, IEFP '96 is the largest food and beverage processing machinery show in the Americas. The 1996 show will have over 20,000 m² of exhibits by over 350 companies. The IEFP '96 also features:

Machinery pavilions for: beverage can manufacturing; canning & freezing; dairy; instrumentation & controls; and meat, poultry & seafood.

For booking, contact:

FPM & SA, 200 Daingerfield Road, Alexandria, VA 22314 USA. To register by Phone, call 703-684-1080, or Fax 703-548-6563.

FEED & GRAINTEC CHINA '96

Venue: Beijing, China

Date: 28-31 October, 1996

Feed & Graintech China '96 will be held in the modern China World Trade Centre complex in the heart of Beijing.

Supported by local ministries, authorities and companies, Feed & Graintech China '96 will provide the Chinese milling industries with a supermarket of the best ingredients, equipment and services on offer and valuable access to a major international conference.

For further details contact:

Andy West, Feed & Graintech China '96, Turret Group PLC, 171 High Street, Rickmansworth, Herts WD3 1SN, UK. Tel: +44 1923 777000 or Fax: +44 1923 771297.

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ASIAN FOOD TECHNOLOGY '96
(AFT '96)

Venue: Kuala Lumpur, Malaysia

Date: 24-27 September 1996

To be held at Putra World Trade Centre, AFTP '96 / AFT '96 will feature the widest exhibit profile, ranging from post harvest processing to bulk distribution, which includes products, equipment and services for processing, packaging, packaging materials & supplies, labelling & bar coding, Catering ingredients & additives, storage & material handling, waste treatment technology, air-conditioning & refrigeration, transportation, quality control, and research and development.

As Malaysia's exports of processed food products increase, with growth from RM 812 million (US\$ 318 million) in 1986 to RM 2,410 million (US\$ 945 million) in 1994, it will not only face increasing competition but also barriers in the form of health regulations and other trade challenges. To ensure that the industry remains competitive, efforts will need to be directed at upgrading food processing technology, encouraging higher automation, improving food quality, safety and health standards as well as products design and packaging that will conform to these regulations.

**INTERCOOL, INTERMEAT
INTERMOPRO**
Venue: Düsseldorf, Germany
Date: Sept 8-11, 1996

From 8-11 September of this year, for the very first time, over 600 exhibitors filling some 27,000 net m² of exhibition space will convene to simultaneously present three food trade fairs at the Düsseldorf Trade Centre. InterMopro, established in Düsseldorf in 1990, was joined by the International Trade Fair for Frozen Foods, Ice Cream and Refrigeration Technology, InterCool, in 1994. This year, a third event, InterMeat, International Trade Fair for Meats, Cold Meats and Sausage, will join the line up.

All three trade fairs will offer a representative look at the national and international trends in their sectors. They will present the visitor with the most innovative and important sectors within the food-stuffs industry generating a multitude of synergy effects between the three parallel exhibitions.

For booking, contact:

Messe Düsseldorf, Postfach 10 10 06, D-40001 Düsseldorf, Stockumer Kirchstraße 61, D-40474 Düsseldorf. Telefon: (0211) 45 60 01. Telefax: (0211) 45 60 668.

IMEGA '96

Venue: Munich, Germany
Date: 21-25 September, 96

At Imega '96, the 4th International Trade Fair for the Restaurant and Catering Industries and for the Food Trade, at the Munich Trade Fair Centre, exhibitors of technical products will show how these are manufactured from ecological viewpoints. The companies concerned have stated that environmental protection is a corporate objective and have put their corporate environmental policy into practice with an efficient environmental management system.

For the manufacturers of technical products, environmental management means, for example, that even product development contributes substantially to the

BOOK REVIEWS

FOOD RETAILING AND DISTRIBUTION: ISSUES AND OPPORTUNITIES AROUND THE WORLD, 1995 A Report by FMI in association with Coopers & Lybrand, Food Marketing Institute, 800 Connecticut Avenue, NW, Washington, DC 20006-2701. Tel: 202-452-8444.

Top food retailing and wholesaling executives around the world recognize that putting the consumer first is critical to competing successfully in the 1990s and into the next century, according to a new report from Food Marketing Institute (FMI).

The major theme to emerge from the 1995 FMI survey is the shift from an internal, operations-driven focus—a strategy that restructured the retail and wholesale food industry in the 1980s—to the next stage of development: a renewed focus on the consumer. The importance of consumer lifestyles to executive moved up to third in 1995, from sixth place in 1994. Competition and operations remained the executives' first and second ranked issues, respectively, in 1995. These rankings have remained the same since 1993.

The survey focused on the competitive and strategic issues facing retailers and wholesalers in eight regions: Africa/Middle East, Continental Europe, United Kingdom/Ireland, Latin America, North America, Australia/New Zealand, Japan, and other Pacific Rim countries.

To meet the evolving needs of consumers and focus specifically on the changes that affect their local customer base, executives are implementing a number of strategies. Competition has been ranked as the top issue for four of the last five years in the study. Competition from traditional supermarkets was cited as "very important" by 49 per cent of the executives in 1995—ahead of competition from all other sources. Competition from new types of food stores was cited as "very important" by 31 per cent; from foreign companies, 27 per cent; discount retailers selling nonfood items also sold in supermarkets, 19 per cent; away-from-home eating, 15 per cent; specialty perishable outlets, 14 per cent; and nonfood retailers, 12 per cent.

The other significant change in rankings this year was in nutrition and food safety.

Globally, executives are emphasizing these issues more, ranking them together seventh last year, up from ninth in 1994—a position nutrition and food safety had held since 1991.

Food Retailing and Distribution: Issues and Opportunities Around the World, 1995, contains sections on the eight regions and chapters on trends and changes in business operations and relationships with suppliers, governments and regulatory agencies.

MAJOR SPICES OF INDIA — Crop Management And Post Harvest Technology" PP 1-514 + (xxii) by J.S. Pruthi. Pub. by Indian Council of Agri. Res. (ICAR) New Delhi-12, Price Rs. 200/- only (subsidised). Profusely Illustrated. May, 1993.

From time immemorial, India has been famous for her quality spices which now earn foreign exchange to the tune of about 6,000 million rupees annually, while the current world spice trade is around 1,500 million US dollars (i.e. 57,500 million rupees). India is one of the largest producers and exporters of quality spices and spice products and has rightly earned the name of 'Home of Spices'. But, it is rather surprising that so far, there is not a single book on crop management and post-harvest technology of spices. The ICAR therefore decided to bring out 2 technical monographs on spices and requisitioned the services of Dr. J.S. Pruthi, an eminent Agricultural Scientist and Spice Technologist, to write these 2 monographs entitled (1) Major Spices of India-Crop Management and Post-harvest Technology, (2) Minor Spices and Condi-

The present first comprehensive and authoritative compendium on 'Major Spices' covers 5 most important spices (pepper, cardamom, chillies, ginger and turmeric) which together earn us about 75-87% of the total annual Indian spice export earnings. The book comprises 8 chapters, the first being 'Introduction' covers nomenclature, history, role of ICAR, some CSIR laboratories, other departments and universities engaged in spice-development programmes, present production, export and future plans for spice development. Chapters 2-6 de-

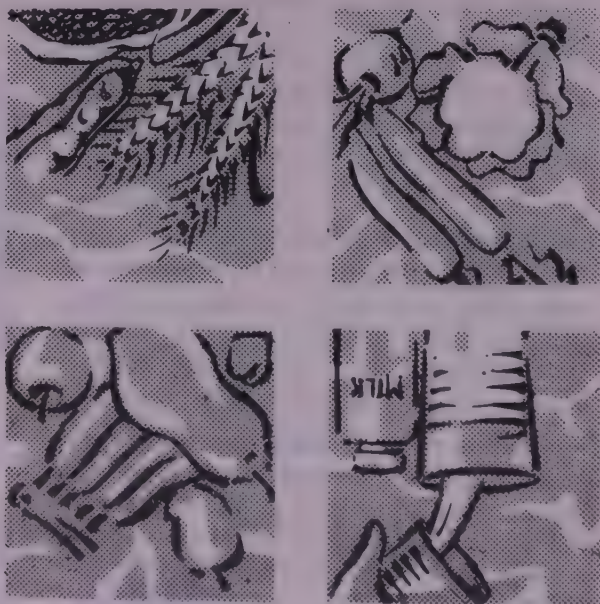
scribe one spice each on a common format for all the 5 major spices referred to above viz. nomenclature, economic importance, production, export, cultivation or crop management, plant protection, post-harvest technology, warehousing, marketing, processed products and end-uses. Each chapter is supported by comprehensive select bibliography. Chapter 7 deals with Agmark (National) standards for each spice. Besides the ISI and International standards for spices, their methods of test have also been listed. In Chapter 8 are given numerous practical suggestions for future research and development programmes. An update (55 pp) on the latest R & D work on the said 5 major spices has been provided. At the end, 17 annexures containing useful information to the readers/users have been appended. They are followed by index.

It is hoped that this publication which is the first of its kind in India and possibly in Asia, Africa, and Latin America, will be of great practical value to spice growers, agricultural scientists, technologists, teachers, students of all agricultural universities, entrepreneurs, as well as those engaged in processing, packaging, quality control, standardization and export marketing of spices.

UNDERSTANDING NATURAL FLAVOURS by J.R. Pigot and A. Paterson, Department of Bioscience and Biotechnology, University of Strathclyde, UK. Published by CTI Publications Inc, 2619 Maryland Avenue, Baltimore, MD 21218-4547 USA. 352 Pages. Price : \$ 158.00 Outside USA.

Advertising claims that food is natural. However, there is only limited published literature on what constitutes natural food flavours. This volume reviews our present state of knowledge of the origins and perception of natural food flavours and the effects of processing, including discussion of the importance of flavour and its effect on food acceptance to the consumer, and the biotechnical methods which will be important in the future development of flavour science. Flavours are categorized by source, allowing the importance of flavor components and variation of flavors within particular foods to be analyzed.

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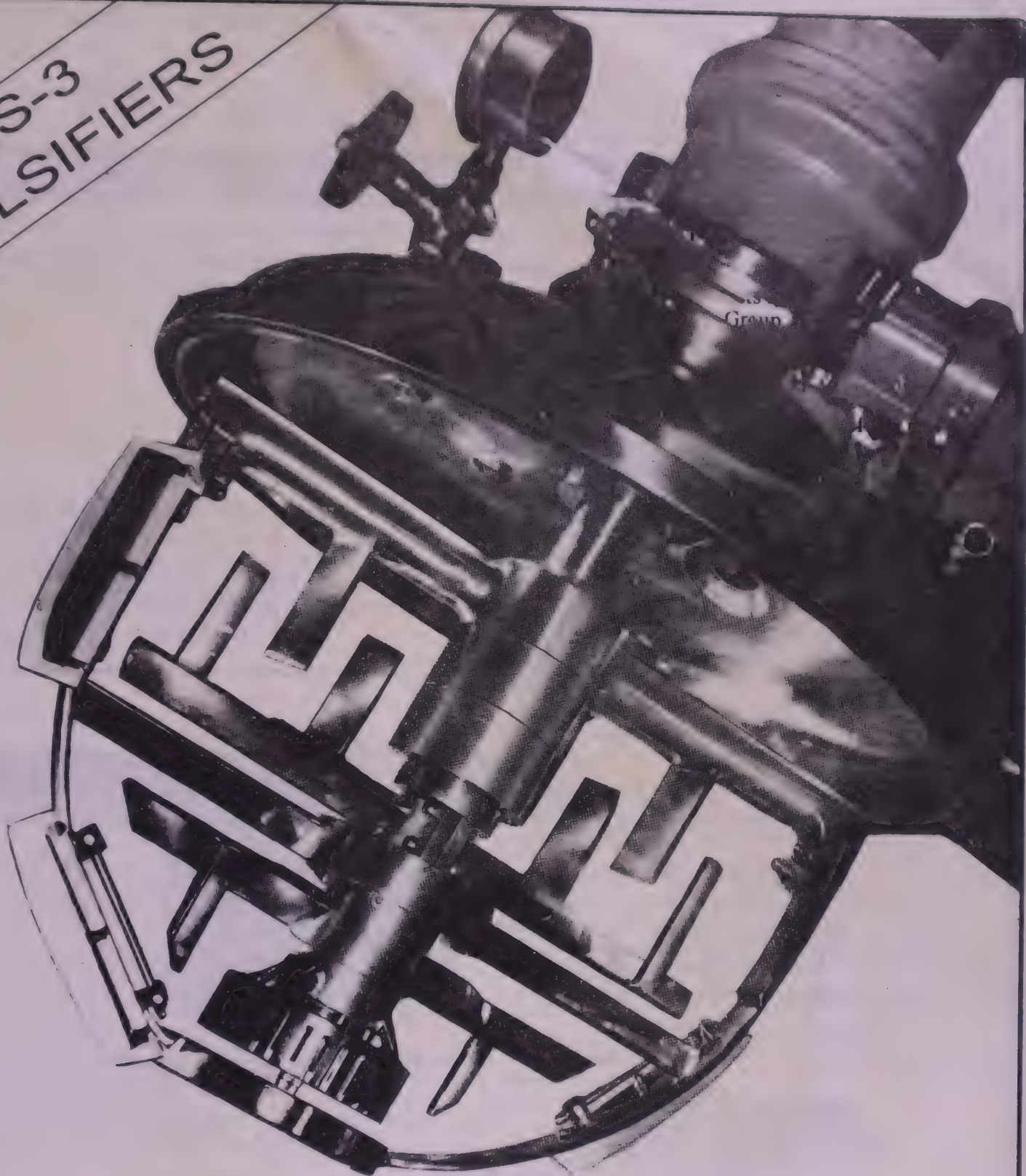
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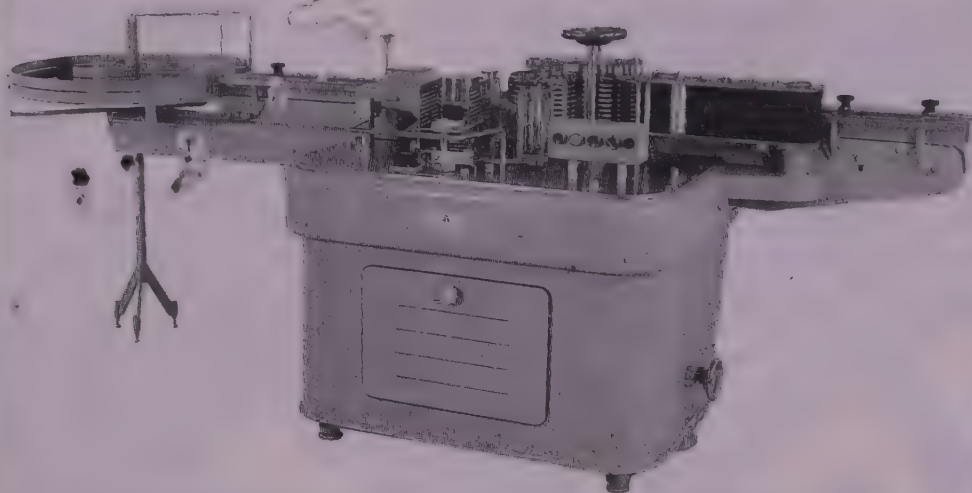
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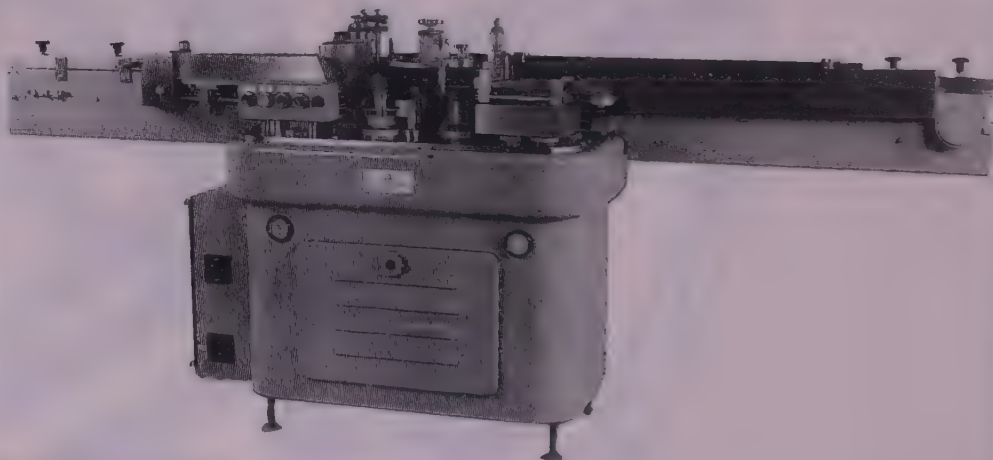
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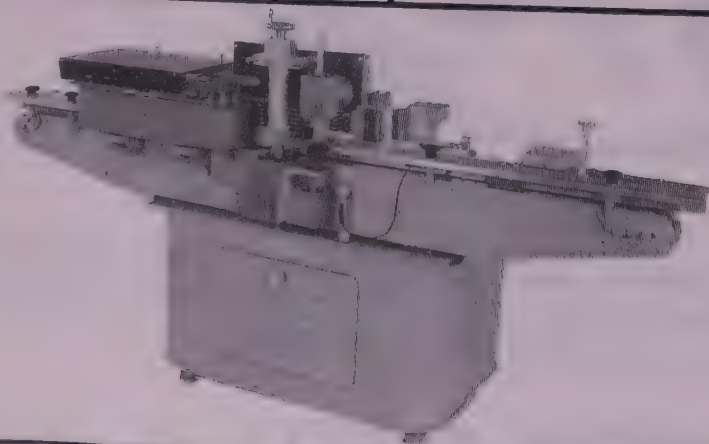
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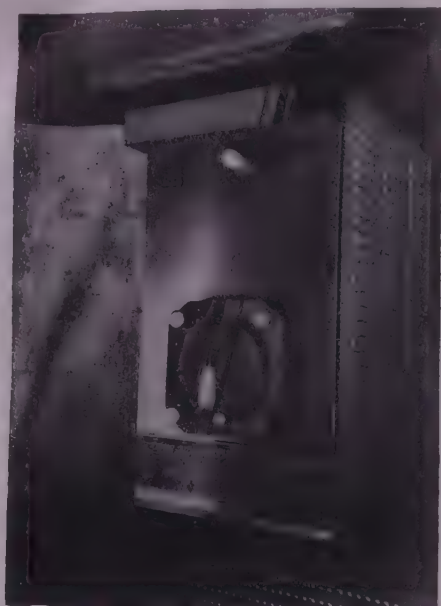
The Galaxy Icecream maker is an indigenous device that prepares fresh icecream. Its special features incorporate a spring loaded beater for uniform scraping of the frozen film.

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RIECO has following technical collaborators for various equipments : Klockner Becorit Industrietechnik, Germany for Pneumatic Conveying Systems; Clean Gas System, Inc. U.S.A. for high Efficiency Scrubbers and Cyclones; Apparatebau Rothemuhle, Germany, for Multicell Dust Collector; Intensivfilter GmbH & Co. KG, Germany for Air Pollution Control Equipments required for high temperature applications; S+S Metal Suchgerate and Recycling Technik GmbH., Germany for Metal Detector/Separator

Size Reduction Equipment consists of Crusher, Bantam Hammer Mill, Hammer Mill "Mikro-Pulveriser", Universal Mill, Air Classifying Mill, Product Collection Systems to be used with above Machines.

Air Pollution Control Equipment includes High Efficiency Cyclones, Multiclones Dust Collectors (Bag Filters), Scrubbers-Ventury, Multivane, Gas Cleaning Systems, Tubular Cooler.

Pneumatic Conveying Systems include - Lean Phase & Dense Phase and Pressure & Vacuum Type.

Other Products : ● Rotary Airlock Valves ● Horizontal Unloading Valves ● Divertor Valves ● Flap Valves ● Screw Conveyor ● Ribbon Blender ● Industrial Fans ● All Metal Detector / Separator ● Packaging Machines.

RIECO through its longstanding experience has acquired capability to design, manufacture and supply the systems for agreed performance characteristics, involving above equipments and related accessories. It has established customer oriented test facilities to establish design parameters for pulverising of various materials, dust collection system and Pneumatic Conveying Systems. The testing laboratory is equipped with sophisticated measuring equipments. RIECO has access to a vast databank received from collaborators. Its Research &

Laboratory is recognised by Council of Scientific and Industrial Research.

RIECO has successfully designed, manufactured, supplied, erected and commissioned various systems for different fields of applications

For further details contact

Rathi Industrial Equipment Co. Ltd.

Office : 1162/2, Shivaji Nagar,

Behind Observatory,

Pune-411005,

Tel. : 325284, 325215 Tlx. : 0145-7798 RICO-IN

Fax : (0212) 323229.

MECHANICAL VARIABLE SPEED DRIVES

'Multispeed' presenting the mechanical variable speed drives is designed to totally enclose, oil lubricated, stepless position variable speed drive unit. It works on principle of friction drive, through double conical roller having metal to metal contact with driving and driven element through an extremely thin electrohydrodynamic film of lubricant between contact surface effecting smooth transmission of power.

Speed variation can be obtained from - Maximum speed = $1.7 \times$ Input speed & Minimum speed = $1/7 \times$ input speed. This has provided versatility to machine by enabling it to be adjusted to the speed in changing job conditions : Operators size & shapes, Material production schedules. The benefits are maximum production, Reduction in manufacturing cost.

Application : Agitators/Stirrers, Conveyors, Wire drawing machine, Extruders, Printing & Packing Machines, Textiles machine, Bottling plants, Rotary pumps, soap industries etc

For more details write to :

Union Enterprises

113, Nagindas Master Road,
Fort,

Bombay 400 023

Tel : 267 13 68/ 267 65 60 / 267 53 16

Fax : 2674071, Gram : UNIPUMP

KITCHEN FOIL

'Kitchen Foil' made from pure aluminium, offers you all these remarkable benefits : perfect protective material, non-toxic, odourless and having no taste of its own. Made from pure aluminium, 'Kitchen Foil' cools and heats rapidly. It is light and flexible yet firm enough. You can fold it into any shape you wish.

'Kitchen Foil' comes in convenient rolls measuring 9 mts in length and 300 millimetres in width. With the easy tear device, you can easily cut only as much 'Kitchen foil' as you need.

Also offered is Cling Film which provides an excellent seal. Cling Film adds gloss and lustre to your food presentation providing the perfect "Fresh Today" appearance that's so important to consumer appeal.

It is ideal for Restaurants, Cafeterias, Caterers, Airlines, Schools, Self Service Outlets, Coffee shops, Company Canteens, Hospitals, Food stores etc.

A quick economical and hygienic process for food wrapping and protection, Cling Film keeps the flavours, freshness and

taste inside and prevents mixing of flavour transfer from one food to another. Very convenient for use in Freezers, Refrigerators, Microwave oven.

For further requirement, contact :

Foil Impex (Bombay) Pvt. Ltd.

66, Bharat Mahal,

86, Marine Drive,

Bombay - 400 002

Tel : 91-22-2017202 / 2011401 / 4939756

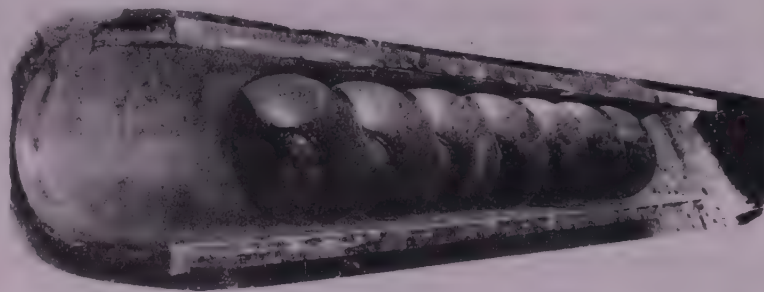
Fax : 91-22-4950467

MATERIAL HANDLING EQUIPMENT

Waghela Brothers are one of the leading manufacturers and suppliers for bulk material handling equipments and systems and spares all over India.

These equipment give more versatility, more accuracy and are easier in maintainance for higher profit at a very competitive price. Bulk handling equipments are: All types of - Screw conveyors, Bucket Elevators, Roller Conveyors & rolling equipments, Rotary Feeders, Belt conveyors, Loose Screw Flights, Loose buckets and other such equipments. The size ranges from 25 mm dia x 25 mm pitch upto 2000 mm dia x 2000 mm pitch (1 mm to 25 mm thk in M.S. & S.S.)

They also provide valuable assistance on all your problems involving material handling systems.



For details & requirements, contact:

Waghela Brothers

Gala No. 1, Oswal Compound,

Behind Trimuph Ind. Estate, Pandit Nehru Road,
Mulund Link Road, Near W.E. Highway, Ett Bhatti,

Goregaon (East), Bombay 400 063.

Phone : 8744131, 8746502.

Fax: 91-022-8746502

FOOD PROCESSING MACHINES

The Company manufacture a wide range of food processing equipment such as Pulper Machine with capacity 1/2 tonnes/hr, Super-Pulper Machine with capacity of 1 to 1/2 tonnes/hr., Junior Pulper-Cum-Finisher with capacity of 1 tonnes/hr. The Mini-Pulper has a capacity of 500 kg per day suitable for extracting pulp from vegetables and fruit. Canning Retort, Fruit Crusher or Mill with fruit feeding hopper inside capacity: 700 kg to 1500 kg/hr.

Also manufactured by Geeta Food Engineering are Jacket Pans, Exhaust Box, Juice Extractor, Coconut & Chilling, Grinding Machine, Bottle Washing Machine, etc.

For your requirement, contact:

Geeta Food Engineering,

Ashirwad Complex, Vashi Village,

Opp. Starling Hospital, Gala No. 2,

New Bombay 400 703.

Tel : 022-7662098, 7667069

Fax : 91-22-7667069.

BISCUIT/BREAD BAKING OVENS

Admir Enterprises are manufacturers of all types and any size of Gas & Oil Fired Automatic Biscuit & Bread Baking Travelling Ovens, which are designed to run Direct & Indirect Gas & Oil Fired for Biscuit & Bread Baking Plant, Barrel Drying, Tin Metal Printing etc.

These Indirect Oil & Gas Fired Ovens are specially suited for all varieties of quality biscuit.

The ovens are more efficient in terms of baking performance and fuel consumption. The temperature profile for each variety of biscuit is automatically maintained as per requirement. These ovens are in use all over India and Abroad.

For further details, please contact:

Admir Enterprises

Plot No. 1/E-4,

Shivaji Nagar,

Govandi

Bombay 400 043

Tel : (Office Cum Resi) 5568446, 5511718, 5518182

Fax : 91-22-5568446

HOMOGENISER

Goma Engineering Pvt. Ltd. has developed import substitute 100% indigenous high pressure Homogeniser for Dairy, Food, Pharmaceutical, Chemical, Cosmetic and the Biotechnological Industries.

The Company offers different models in the range from 50 to 18000 LPH and pressure upto 400 bar. The salient features of Homogeniser are High Pressure Triplex and Quintuplex Pump, two stage homogenising heads, all contact parts are made of special type of stainless steel and sanitary design for cleaning. It has the characteristics of new structure, easy operation, simple maintenance and labour saving in dismantling and assembling.

It can homogenise fluids like milk, ice cream, juice and all kinds of emulsion due to high pressure operations. The product becomes more easy to digest, absorb, smooth, stable and homogenous which gives more value addition to the product.

The Company has developed World Class Technology with the help of National Dairy Development Board. Some of their valued clients among others are Maharashtra Government Milk Scheme, Parle Beverages Ltd., Pepsi Cadbury (I) Ltd., Raymonds, Shivamrut Dairy, Dukes, etc.

For more details, contact:

Goma Engineering Pvt. Ltd.

Majiwada, Behind Universal Petrol Pump,

Thane - 400 601 (Bombay).

Tel : 5340875 / 6436 / 1937 / 6121

Fax No. : 0091-22-5333634

Tlx : 011-72389 TCWE IIN

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The Quest for Quality

CARAMEL COLOR APPLICATIONS

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Soft drinks
Beverage products
Blended whiskey
Wines, Brandy, Vermouth

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Dark breads
Cookies
Cake Mixes Dark
Cake Mixes Light

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Seasoning mixes
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Condiments
Flavouring Extracts
Preserves

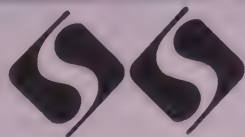
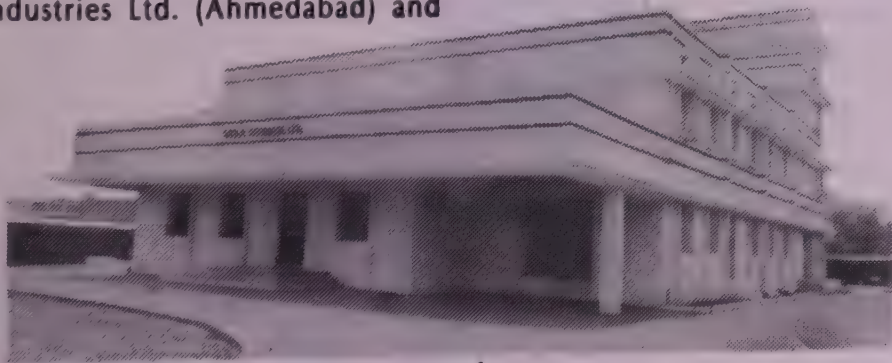
OTHERS

Cocoa/Chocolate
Coffee extender
Textured Proteins
Pharmaceuticals
Candy/Licorice
Vinegars
Dairy Products
Cereals
Soups

Sethness Products Co. (U.S.A.) to manufacture Caramel colors. Sethness Products Company is a dedicated Caramel manufacturer since 1880. Today, they have the best technology in the world. Over the century they have developed and standardized the manufacturing process to obtain a product that meets the highest standards. This rich experience combined with their R & D back-up is available to us to bring to you the best product to meet every possible range of color, strength and hue. Sayaji Sethness is always willing to evaluate your particular application and offer technical support to match our products with your requirements.

Caramel Color has been used for generations to improve the taste and appearance of foods and beverages. Imparting color ranging from delicate yellow to the darkest browns, it remains a versatile and cost efficient coloring agent.

This unique color is now brought to you by Sayaji Sethness Ltd. - a joint venture company promoted by Sayaji Industries Ltd. (Ahmedabad) and



SAYAJI SETHNESS LTD.

17/18 GVMM, Odhav, Ahmedabad-382410, India.
Tel: (079) 2875100 Fax: (079) 287338 Telex: 121-6756 MAIZ IN



KNS-ADI

INSECTOCUTOR

PEST-O-FLASH flying insect control system is widely used throughout the country in hotels, restaurants, canteens, dairies, bottling plants, pharmaceutical companies, bakeries, food processing and canning industry, fisheries, abattoirs, wherever flying insect control is important.

The Pest-O-Flash flying insect control system from Pest Control (India) Limited is a proven approach to killing flies: conveniently and hygienically. Kills flies continuously without interrupting production, customer traffic or any activity; is low priced and noiseless; the running costs are very low, like using a tube light at home, and is so economical; absolutely safe, with plastic coated M.S. guards provided. Above all there are no fumes, no chemicals, no odours.

The system comes in various models to suit different needs of customers.

For your requirements, contact:

Pest Control (India) PCI Limited

Marketing Division:

127, Keytuo Ind. Estate,

220, Kondivita Road, Andheri (E)

Bombay 400 059.

Tel : 821 7385, 821 3546, 821 3547. Fax: 822 1647

AIRCONDITIONING AND REFRIGERATION

Airconditioning Specialities established in 1966 is a pioneer and original manufacturer and exporter of complete plants as well equipments. They are known for Central AC plants for comfort and sterile air, low humidity air and ventilation, exhaust systems, Freon & ammonia based water and brine chilling plants upto (-) 50 C, Freon and Ammonia condensers, chillers, cooling and heating coils, coil storages, heat exchangers, after coolers, Heliflows for drinking water operated by central chilled water plant, Air handling units, Fan-coil units, FFans, Blowers, Freon and Ammonia air cooling product coolers, Air curtain units, Air filters, Air grills, Volume control Dampers, Ducting jobs, Insulation jobs. Apart from above, ACS is equally known for repairing and revamping old plants, old condensers, chillers and heat exchangers. In the field of Freon based chilling plants ACS is making Special Star-fin tubes double fin type for high efficiency of the plant, less gas charge and for complete evaporation of Freon gas from chiller so that compressor life is increased. ACS has also developed Star-fin tube suction line Heat-Exchanger for the Freon AC plants as well chilling plants to sub cool liquid coming out of Condenser and superheat suction gas before entering the compressor. This results in extra benefit of long life of compressor.

For more details, contact:

D.R. Patel MS(Illinois-USA)

Airconditioning Specialities

40 GIDC Estate, Makarpura,

Baroda 390 010.

Tel: 442337 (Resi) 324015. Fax: 442337.

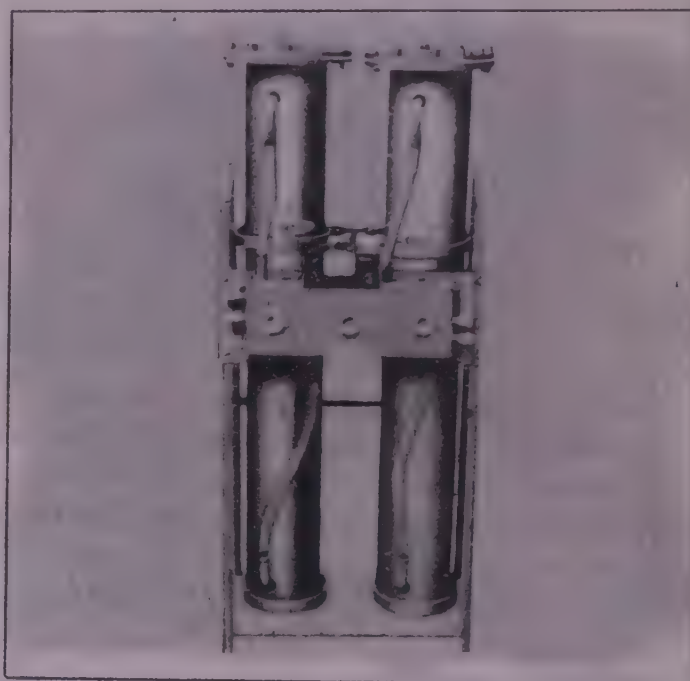
ULTRA VIOLET WATER DISINFECTOR

Komal UVK Series provide a compact design and econom-

ical Ultra Violet treatment for water application for a wide range of applications in Mineral Water manufacturing, Pharmaceutical, Drinking water, etc.

Komal manufacture UV Disinfector which has very high radiating U.V. Lamps which emits the killer U.V. wavelength 253.7nm. In its unique feature lamps are isolated from water by placing them inside specially fused quartz glass sleeves which emits 95% of the incident UV radiation. UVK Series of UV Disinfector having Dosage more than 30 micro sec/cm² can kill micro organisms most reliably.

Komal Disinfector asks for very little maintenance. It is provided with add-on accessories to help monitor and optimise its performance. UV Disinfectors are available in various models having flow rate ranging from 500 lits/hr, 800 lits/hr, 2000 lits/hr, 5000 lits/hr. in stainless steel construction.



For more details contact:

Komal Industries,

307, Goradia House,

104, Kazi Sayed Street,

Bombay 400 003.

Tel : 344 6561/3447304

Fax : 91-022-3446561.

COMPRESSOR PARTS

Now imported compressor parts from U.S.A. from the world's leading manufacturers are available on fast deliveries. We have an access to 50,000 parts inventory in U.S.A. which are available for immediate shipment. We also have a very powerful sourcing system in U.S.A. and European countries. Parts are available for compressors of all world leading makes Air / Gas / Refrigeration (reciprocating / screw / centrifugal) parts are delivered against rupee payments at very economical rates. Regarding popular Indian compressors such as Ingersoll-Rand / K.G. Khosla / C.P.T. / Kirloskar / Atlas Copco etc. Most of the fast moving parts for Indian compressors are also available ex-stock from U.S.A. The landed cost works out to be cheaper than OEM'S in India. Transworld offers easy / excellent tailor made payment facilities to suit individual customer requirements. We

also have an access to all brands of imported parts for engines. We also manufacture DG sets upto 1200 KW and are available for sale / hire / boom - built own operate maintenance.

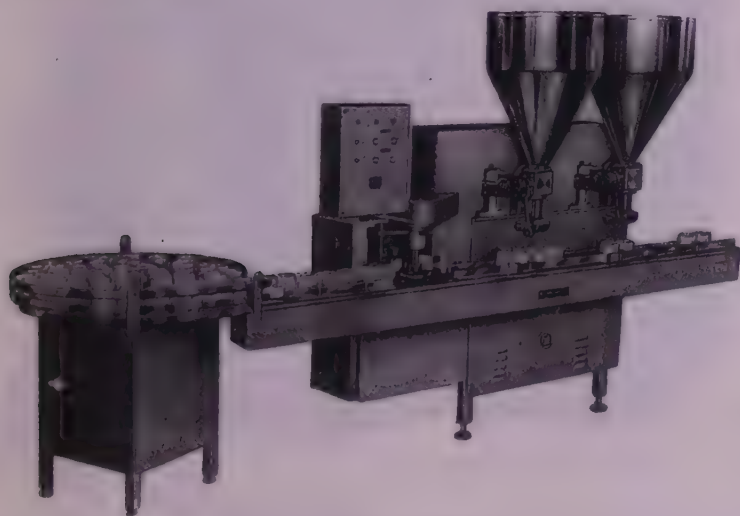


For further details, contact:

Transworld Compressor Technologies
11 Rajaram, South Main Road,
Koregaon Park, Pune - 1
Tel: 91 (212) 638916
Telefax: 91 (212) 638272.

CREAM FILLING MACHINE

Autopack manufactures Automatic Twin Head Cream Filling Machine, Model CF-70 for accurate filling of products of various viscosities in Jars, Containers and Bottles of different shapes and sizes, with an accuracy of $\pm 1\%$. Filling capacity ranges from 5 gms to 1 kg and output upto 60 fills/minute. The machine has a positive cut-off valve for drip free filling. The quality of fill can be easily adjusted. Power input is 2 KW. The machine can be linked with Automatic Machines like Sealing, Capping etc. The machine is suitable for filling creams, adhesives, balms, gums and food, pharmaceutical or cosmetic products in cream form.



For further information, please contact:

Autopack Machines Pvt. Ltd.
101-C, Poonam Chambers,
Dr. Annie Besant Road,
Worli, Bombay 400 018.
Tel: 4924806/4925900/4964926
Fax: (022) 4964926. Tlx: 11-73798

COOLING TOWERS

The company, established in 1974, is a pioneer and original manufacturer as well recognised exporter of complete range of cross flow towers, counterflow towers, furnace towers, DC set forced draft towers, Timber fanless towers, FRP hollow blades, FRP solid blades, Chemical timber parts & components as per IS-401, Spray nozzles, PVC fill slabs, FRP grid supports, Gearless tower fans, Large Exhaust fans upto 78" monoblock type, Cold storage doors with & without Electric defrost heaters. CTC is equally known for repairs/revamping of old cooling towers of any make and for anywhere in India and abroad. Their towers are already exported to nearby countries. CTC has developed a special VIP series cooling towers which are driftless and energy saving as well non-clog type.

For new towers the data required are:

- (1) Flow rate of hot water to tower in LPM
- (2) Hot water temperature to tower
- (3) Cold water temperature expected from tower
- (4) Design wet bulb temperature-average monsoon wet bulb temperature.

For more details, contact:

D.R. Patel, MS (Illinois-USA) .BE(Mech) MSU. FIE.
Cooling Tower Corporation
40/B GIDC Estate, Makarpura,
Baroda 390 010.
Tel: 442337 (Resi) 324015
Fax: 442337

DISPOSABLE CONTAINERS

Various containers such as cup, glasses, meal trays etc are manufactured by the company and they can also develop a special product as per the specification provided.

The company assures you of the highest quality products at a reasonable rate which will be most competitive as compared to the market.

Other products from Suraj Enterprises are Display Trays, Blisters for packing of various consumer items, pharmaceutical trays, etc.

For your requirement, please contact:

Suraj Enterprises
18, Vinita, 10th Road, Chembur,
Bombay 400 071.
Tel: 5567447. Fax: 5113850.

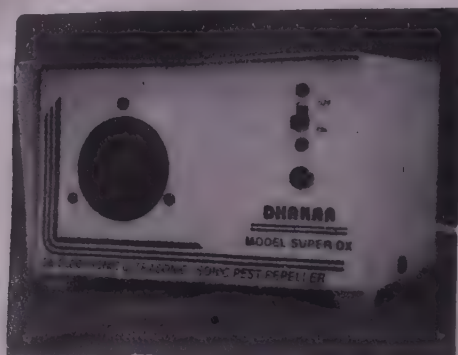
ULTRASONIC PEST REPELLER

Dhakar Engineers manufactures a compact, noiseless, maintenance free, yet a powerful Pest Repeller. This DE Ultrasonic Pest Repeller transmits high intensity, high pitched sound. This sound generated penetrates the pests brain and nervous system and causes fear, discomfort and creates intolerable environment for various pests. The pitch of the sound being ultrasonic i.e. beyond the audible range of the human being, is soundless

to man and hence has no side effects.

Unlike the conventional method of pest eradication which uses chemical, poison, spray, mats etc. This Pest Repeller is completely harmless, with infinite life, low power consumption, no fuel, and works continuously for 24 hours a day 365 days a year.

DE Ultrasonic Pest Repeller has three modes of operation and also three frequency ranges on which it works. It is suitable to repel effectively all pests like Rats, Bats, Cockroaches, Insects, Lizards, Spiders etc.



For further details, contact:

Dhakar Engineers

Post Box No. 196, 90,
Janakpuri

Opp Dhauji Ki Bawdi,
Near Pratap Transport Nagar,
Debari,

Udaipur 313 024 (Raj)

Tel: 414045, 410926, 413259, 414002, 410002

Fax: (0294) 410928.

PNEUMATIC-BLENDERS

Reimelt offers a high capacity pneumatic-blender for gentle blending of fluidisable ingredients of similar consistency. Application is as blender for all dry ingredients in the food, pharmaceutical and chemical industries; as weighing unit mounted on load cells with connections to electronic control centre in fully automated production process (filling, mixing and discharge); and as pressure vessel (up to 4 bar absolute pressure-tight) for pneumatic conveying for high capacities and long distances. Special designs available are: liquid spray-in nozzles for liquids and fats, spray-head for wet cleaning, lump breaking device, cooling and heating of products, air purge for complete discharge, load cells for electronic weighing with data registration, tandem arrangements for double capacity.

Advantages of pneumatic blending are: extremely short mixing cycle; elimination of any mechanical stress against the product through agitation results in gentle mixing; clean mixing vessel, easy sanitation; conveying and blending media is the same, excellent heat transfer through intense turbulence during mixing; start/stop of mixing process is in seconds; minimal maintenance and inspection costs due to non-existence of mechanical devices; feeding and discharge time extremely short; extremely high integration possibilities; and universal applica-

tion.

For more details write to:

Reimelt India

6 Prachi, off Bhandarkar Road,

913 Deccan Gymkhana,

Pune 411 004.

Tel/Fax: (0212) 352451

RACK OVEN

The heat Transfer Technology of a "Revent" Rack Oven is Unique! - Heat is transferred to the Baked Products to give effective Bottom Heat for better Oven Jump and even Colour to achieve highest baking results.

The Large Air Volume System used by Revent is a much more efficient way to transfer heat to baking products than High Air Velocity Systems.

Using steam during baking cycle is not popular in India. However, the Shine/Colour/Texture/Crust Formation (Bite) of Special Products could be enhanced/controlled by steaming!

Unique Steaming System of "Revent" would help develop innovative new products to meet our growing markets.

The Steel Balls used for Steaming System acts as a heat reservoir, also, to ensure uniform Baking - Rack after Rack.

Revent High Volume Steam System conserves Energy.

S.S. Construction, excellent insulation - Only oven that could be placed with "Zero" Clearance! "Revent" Rack Oven could be placed flush against a wall with no air gap - a major advantage when floor space is at premium.



For further details, contact:

IndianFoods (P) Ltd.

Marketing Office

"Bakery & Food Industry Service Division"

171, K.K. Nagar,

Madurai,

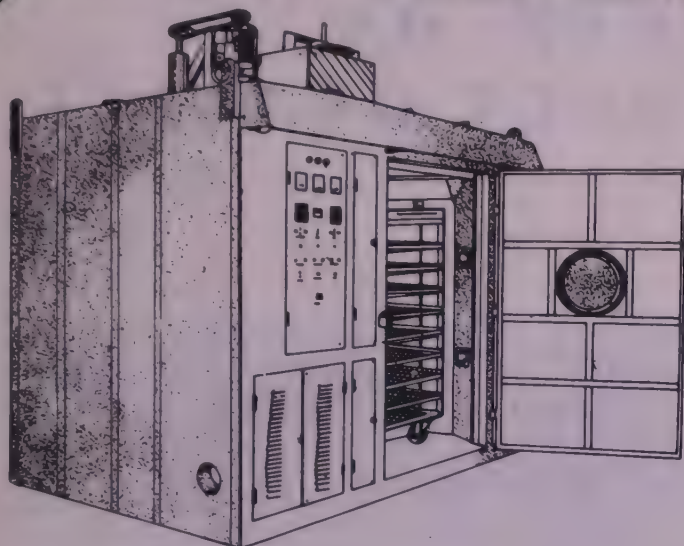
Tel: 0452-42776. Telefax: 0452-41511.

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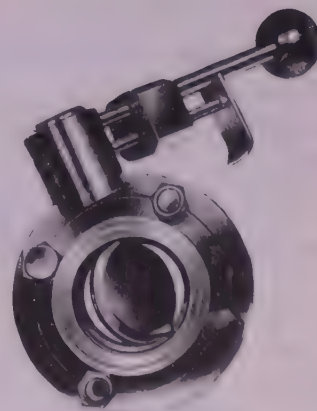
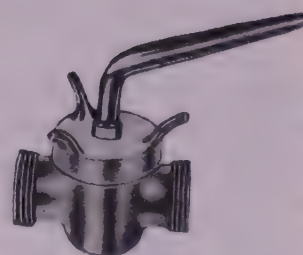
We also undertake Electropolish & Erection of
SS Product Pipeline.

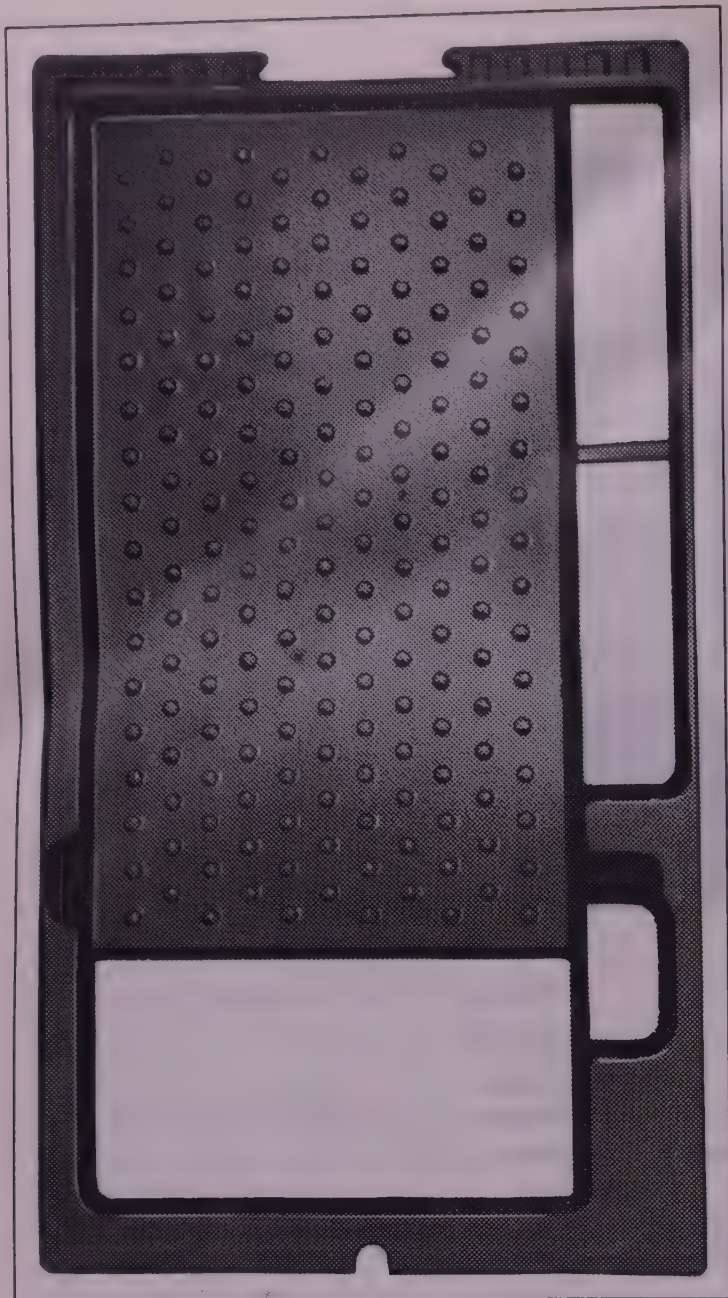
Address:

KAY AAR Compound, J.B. Nagar
Andheri (E), Mumbai 400 059

Tel: 8203586, 8216419, 8202596, 8300230 • (Fax) 91-22-8230747/2040634

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***EXCEPT ON
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**PRESENTING
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In India, despite their known limitations, tubular evaporators have been used extensively, even for evaporation of heat-sensitive products. After all, there was no choice!

But, ECOVAP range of plate evaporators, which PRAJ now manufactures in technical collaboration with APV Anhydro Separation Technologies, USA., will bridge this well identified technological gap.

FEATURES AND BENEFITS

- Shorter residence time - minimizes thermal damage and improves product quality.
- Low liquid volume hold-up further minimizes thermal deterioration.
- High steam economy with lower power consumption.
- Product concentration upto 97 %.
- High viscosity products like fruit purees, juices, candies, sugar solutions etc. can also be handled.
- Minimum fouling tendencies.
- Easy access for cleaning.
- Consistent product quality even at turndown conditions.
- Flexibility in operation. Capacity can be expanded by just adding plates.
- Compact in size, these evaporators save on extensive civil and structural work.

Over 2000 ECOVAP plate evaporators are already in operation the world over for a variety of applications in Food, Beverages, Dairy, Starch, Cosmetics & Toiletries, Pharmaceuticals, Chemicals, Gelatin and a host of other industries.

PRAJ
INDUSTRIES

PRAJ INDUSTRIES LIMITED

Process Equipment & Systems Division

43/2, Erandavana Industrial Estate,

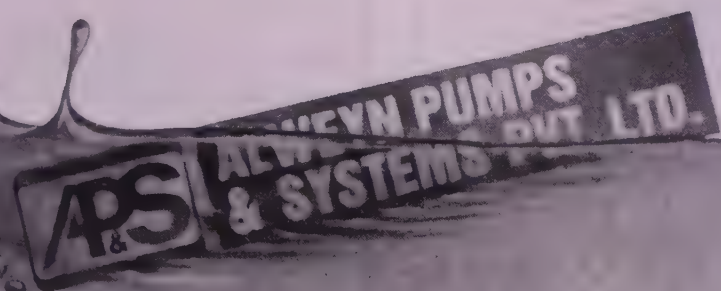
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collaboration
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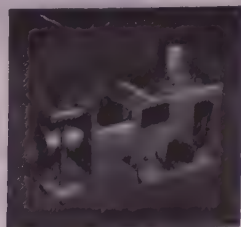
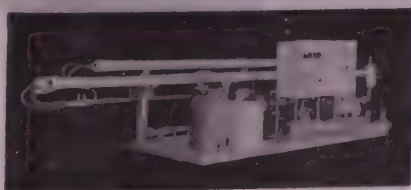
Not that we have anything to hide but such claims as it would occur to you, better be investigated, specially when 'clarity' happens to be a very pertinent aspect. So, the best place you'll look is underneath, and what would you find...

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On further exploration you'll discover we also manufacture Triplex pumps – a 90% energy efficient work horses for use in Reverse Osmosis, Boiler feed, oil rigs, Die casting accumulators etc. And metering pumps for dosing of toxic liquids, corrosive chemicals, abrasive slurries.

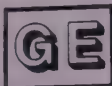
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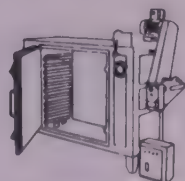
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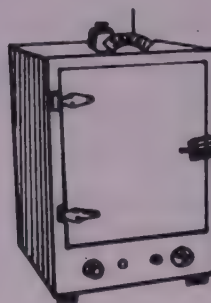


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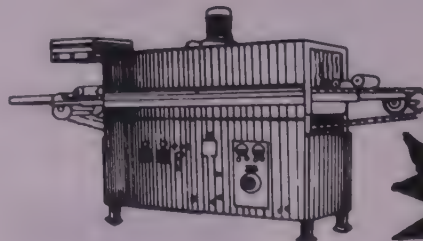


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Food Tech Engineers-- See under "Machinery, Food & Beverage Processing."

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Saffaire India, 51, Juhu Supreme Shopping Centre, Gulmohar Cross Rd., No. 8, J.V.P.D. Scheme, Bombay 400 049. Tel: 6203998. Cable: SAFRIGE

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Food Tech Engineers -- See under "Machinery, Food & Beverage Processing"

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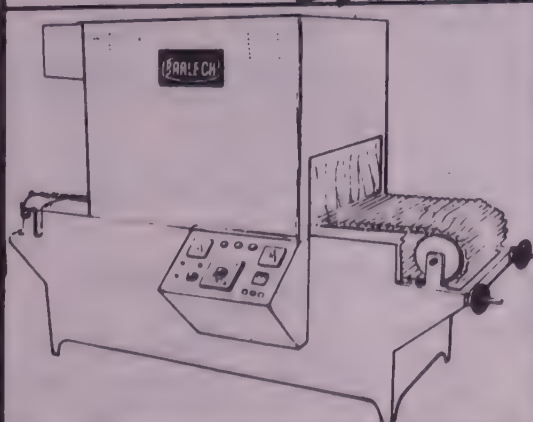
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Food Tech Engineers -- See under "Machinery Food & Beverage Processing".

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Classic Enterprises, 101 Jehangir Mansion, Behind Metro Cinema, Bombay 400 020. Tel: 2088291/2058916.

Santosh Engineering & Fabricators, 97 Nahar & Seth Indl. Estate, 4th Fl., Pannalal Silk Mills Compound, L.B.S. Marg, Bhandup (W), Bombay 400 078. Tel: 5612746, 5692119.

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Bhavnani & Son Pvt. Ltd., Waco House, Masrani Lane, Kurla, Bombay 400 070. Tel : 5144579/87. Fax : (22) 5110318.

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Shivsu Watek (P) Ltd. -- See under "Mineral Water Filling Machinery"

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Techno Equipments -- See under "Food Processing Equipment/Plant".

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Divecha Glass Industries, 155, Maker Chambers VI, 220 Nariman Point, Bombay 400 021. Tel: 241157/241167.

R.G. Glass Industries, 11-B, Petwala Compound, 244, Maulana Azad Road, (North) Opp. Urdu Times, Bombay 400 008. Tel: 3072326/3086984/3099896/3096218. Grams: SUPER-GLASS. Fax : 91-022-3010223

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J.T. Jagtiani -- See under "Machinery, Food & Beverage Processing".

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Goma Engineering Pvt. Ltd. -- See under "Beverage Processing Machinery"

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Samarpan Fabricators Ltd. -- See under "Filling & Sealing Machinery"

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Ganga Singh Sukhwinder Singh Engg. Pvt. Ltd., 1 Vishal Ind. Es-

tate, Village Rd., Bhandup (W), Bombay 400 078. Tel: 5600562/5690572. Fax: 0091-22-5649312.

Santosh Engineering & Fabricators -- See under "Boilers"

Tinmaco Engg. Co. -- See under "Tin Can Making Machinery"

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8390195

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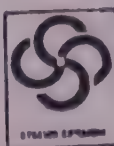


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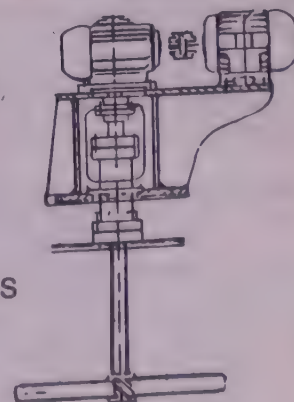
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Advance Equipment Co.-- See under "Airconditioning/Refrigeration Plant & Equipment"

Dr. T.K. Food Consultants, 2A, 4th Floor, Lentin Chambers, Dalal Street, Fort, Bombay 400 023. Tel: 2657206/2651864.

Hindusthan Snacks Ltd., 1/8 Ranthambhor Complex, Zone 11, M.P. Nagar, Bhopal 462011. Tel: 91-755-556476. Fax: 91-755-576319.

Project & Technology Group, 1-E, JIA Sarai, IIT, Hauz Khas, New Delhi.

CONTAINERS, GLASS

Larsen & Toubro Ltd. (Packaging Div.) -- See under "Bottle Caps & Closures"

CONTAINERS, METAL

Aifso Enterprises -- See under "Ovens, Bread/Biscuit Baking"

Divecha Glass Industries (Metal Containers Div.), 249 Bal Rajeshwar Rd., Mulund (W) Bombay 400 080. Tel : (022)-5612548/5617559; Fax : (022) 5671711; Cable : GLASSUNIT; Tlx : 011-85226 GLASS IN.

Petrox Private Ltd. -- See under "BOPP Film"

CONTAINERS, PET/PLASTIC/METAL

Swastik Industries 34/C, Thakker Building, Ground Flr., Gala No. 4, Champsi Bhimji Road, Next to Shrinivas Bldg., New Post Office, Old Anjirwadi, Mazagaon, Bombay 400 010. Tel: 8729366.

Technology Plastics Ltd., No. 10 Haddows Rd., Nungam-

bakkam, Madras - 600 006. Tel: 044-8253879. Fax: 044-834728.

CONTRA-ROTARY MIXER

Cosywo Engineering Company -- See under "Chemical Plant & Equipment"

Metal Plants, 2/17, Anupam Ind. Estate, Lal Bahadur Shastri Marg, Mulund, Bombay 400 080. Tel: 5614439/5610628.

CONTROLLERS

Flow, Liquid Level, Temp. Misc.

Industrial Instruments Co. -- See under "Temperature Indicators/Controllers"

Sakav Enterprises -- See under "Air Driers"

CONVEYOR SYSTEMS

Crystal Automation Pvt. Ltd. -- See under "Pneumatic Conveying Systems"

Ducon Equipments (P) Ltd. 6, Alpana, 2nd Fl., Peddar Rd., Bombay 400 026. Tel : 388-8294. Fax : 91-22-578-7929.

Food Tech Engineers-- See under "Machinery, Food & Beverage Processing"

Indiana Conveyors Pvt. Ltd. (Pneumatic Conveying Div.) Indiana House, Off M. Vasanji Rd., Marol Naka, P.B. 7409, Andheri (E), Bombay 400 059. Tel: 8344743, 8383157. Tlx: 011-75208 IEW IN. Fax: 022-8367154.

Techno Link Conveyor Systems Pvt. Ltd. -- See under "Screw Conveyors"

Waghela Brothers, Oswal Compound, Ett Bhathi, Pandit Nehru Rd., Near W.E. Highway, Goregaon (E), Bombay 400 063. Tel : 874 4131. Fax : 91-022-874 6502.

CONVEYOR COMPONENTS

Superior Engineering Works, Unit No. 23B, Shukla Compd., Near Murbali Talao, Shiv Vallabh Rd., Dahisar (East), Bombay 400 068. Tel : 887 866. Fax : 887 0605.

COOLERS, VACUUM, BATCH

Machinfabrik, B-104, Arjun Centre, B.S. Devshi Marg, Govandi, Bombay 400 088. Tel : 5555596/5560947. Tlx : 011-61002 MAFP IN. Fax : 91-22-556-0569. Gram : Steamset.

COOLING CABINETS

Multifrig Marketing Co. (Ltd.), 1/12 Kirti Nagar, (W.H.S. New Timber Market, New Del 110 015. Tel : 535376, 541627 Fax : 011-5416040.

COOLING TOWER PUMP

Excelsior Engineers, Post Box 26764 F-18 Everard Nagar, Si Bombay 400 022. Tel: 4077556

CORRUGATED BOX/CARTONS

Natraj Paper Box Factory, 117 Ansa Industrial Estate, Sak Vihar Road, Sakinaka, Bomba 400 072. Tel : 5786785, 5786690

CRATES, PLASTIC

A.P. Batliwalla, 81, Sheri devji St. (Chakla), Opp Mohammed Haji Adam & Co. Bombay 400 003. Tel: 3415294 Fax: 3733701

R.G. Glass Industries -- See under "Bottle & Jars"

CRATES, WOODEN

A.P. Batliwalla -- See under "Crates, Plastic".

R.G. Glass Industries -- See under "Bottle & Jars"

CREAM FILLING MACHINE

Autopack Machines Pvt. Ltd. -- See under "Bottle Filling & Sealing Machines"

Food Tech Engineers-- See under "Machinery, Food & Beverage Processing"

Frigmaires Engineers -- See under "Agitators"

CREAM WAFER PLANT

New Indo International (Regd.) -- See under "Pillow Pack Packing Machine".

CROWN CAP PVC LINING MACHINE

Venus Packaging Services, 302 Palm Beach, Versova, Bombay 400 061. Tel: 632 1397/632 1398. Fact: 8113623/8110638/8110640. Fax: 6264835.

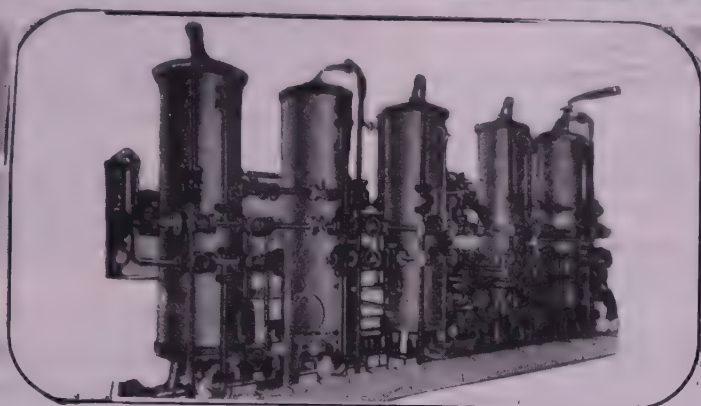
CROWN CAP PUNCHING PRESS

Food Tech Engineers-- See under "Machinery, Food & Beverage Processing"

Venus Packaging Services -- See under "Crown Cap PVC Lining Machine".

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CROWN CORKS

Larsen & Toubro Ltd. (Packaging Div.) — See under "Bottle Caps & Closures".

Standard Tin Works — See under "Caps & Closures".

DAIRY FITTINGS/VALVES

Bhap Trading Pvt. Ltd., 52 Nagdevi Street, Bombay 400 003. Tel: (022) 3424758/3447425. Tel/Fax: 091-22-3424 758. (0265) 442435. Fax: 091-022-3424758.

Metal Craft Engineers — See under "Valves".

DAIRY PLANT & EQUIPMENT

Chengalva Engineering Pvt. Ltd., 9 Bhagyalxami Nagar Colony, Gandhinagar, Hyderabad 500 380. Tel: 7612023. Tlx: 0425-6333 PCO IN. Fax: 091-40-841697.

Fabdecon Engineers — See under "Agitators".

Filtron Engineers Ltd., 117-A, Vithalwadi Road, Pune 411 030. Tel: 091-212-440068. Fax: 091-212-477913. Tlx: 01 45-7323 TRON IN.

Food Tech Engineers — See under "Machinery, Food & Beverage Processing".

Goma Engineering Pvt. Ltd. — See under "Beverage Processing Machinery".

Koooling Systems — See under "Chilling Plants".

'METACOLOR', Shree Precoated Steel Ltd. — See under "Refrigeration Equipment & Plant".

Paul Air Engineers Pvt. Ltd. — See under "Valves".

Saffaire India — See under "Air Conditioning/Refrigeration Plant & Equipment".

DEHUMIDIFIERS

Arctic India Sales, 20, Rajpur Road, Delhi 110054. Tel: 2912800 /2522424/231129. Tlx: 031-78003 AISL IN. Fax: 011-2915127

Koooling Systems — See under "Chilling Plants".

DEMINERALISER

Factor Engineering Co. Pvt. Ltd., A-1/104 Gumbardhan Nagar, Mulund (W) Mumbai 400 080. Tel/Fax: 5601361

Water Testing Services — See under "Water Treatment Plants/Equipment".

DESTONERS

Durai Industrial Works, 1143, Mettupalayam Rd., Combatore 641 043. Tel: 442380. Fax: 91-22-442250

DETECTION EQUIPMENT, Fire / Smoke

Subtronics, Kaliandas Udyog Bhavan, Unit No. 147, Near Prabhadevi P.O. Prabhadevi, Bombay 400 025. Tel: 4224461.

DIGITAL WEIGHT INDICATOR

Acme Sales Company, 324-C Grant Rd., Bombay 400 007. Tel: 3077702, 3081198, 3098628. Grams: ACME SCALES.

DISPENSERS, BEVERAGES

Dairymac Engineering Pvt. Ltd., 25 Madhuvan, Ellisbridge, Ahmedabad 380 006. Tel: 461205, 449538. Fax: 91-79-443537.

Frigmaires Engineers — See under "Agitators".

DISPLAY CABINETS, REFRIGERATED

General Air Conditioning Co. — See under "Cold Storage Plants/Equipment".

DISPOSABLE, CUPS/ TRAYS

Wonderpack Industries (P) Ltd., See under "Bread/Biscuit Packing Machinery".

DOSERS

Goma Engineering Pvt. Ltd., — See under "Beverage Processing Machinery".

Micron — See under "Water Sterilizers".

Water Testing Services — See under "Water Treatment Plants/Equipment".

DRYERS, OVEN/ TRAY, ETC.

Bombay Industrial Engineers — See under "Machinery, Food & Beverage Processing".

Fabdecon Engineers — See under "Agitators".

Food Tech Engineers — See under "Machinery, Food & Beverage Processing".

SSP Pvt. Ltd. — See under "Evaporators".

Sakav Enterprises — See under "Air Driers".

Shirke Structurals Pvt. Ltd. — See under "Silo Storage Systems".

The Bombay Engineering Works — See under "Tray Dryers".

DUST EXTRACTORS

Thor Systems — See under "Air/Dust/Fume Control".

EFFLUENT TREATMENT PLANTS

Aqua Filsep Inc. — See under "Water Treatment Plants/Equipment".

Chemi Filter Corporation — See under "Agitators".

Factor Engineering Co. Pvt. Ltd. — See under "Demineralisation Plant/Equipment".

Paramount Consultants, Raja Market, 1st Fl., New Nagardas Rd., Andheri (E), Bombay 400 069. Tel: 838 3864/822 3835. (Resi) 841 2775. Pager No. (9602) 107 373.

ELECTRONIC SCALES

Accurate Weighing Machines — See under "Weighing Machines".

EMULSIFIERS

Cosywo Engineering Co. — See under "Chemical Plant & Equipment".

Fibre & Fibre Products — See under "Stirrers".

Frigmaires Engineers — See under "Agitators".

Mamko Process Equipment Manufacturers, Post Box No. 19001, Bombay 400 063. Tel: 8886309/8889913. Gram: MIXIN Bombay 400 063. Fax: (91-22) 8822757.

Metal Plants, 17, Anupam Ind. Estate No. 2, Pt. MM. Malaviya Rd., Mulund (West) 400 080. Tel: 561 0628. Fax: 5642040 Attn: Metal Plants.

ENGINEERS & DESIGNERS, CONSULTING (See also under "Consultancy & Design")

Cosywo Engineering Company — See under "Chemical Plant & Equipment".

Frigmaires Engineers — See under "Agitators".

Goma Engineering Pvt. Ltd. — See under "Beverage Processing Machinery".

M.F. Marketing Pvt. Ltd. — See under "Autoclaves".

EVAPORATORS

Filtron Engineers Ltd. — See under "Dairy Plant & Equipment".

SSP Pvt. Ltd., 19 DLF Indl. Area II, 13 Milestone, Mathura Rd., Faridabad 121003. Tel: 0129-275968/277442; Fax: (091)0129-277441/011-6847665; Tlx: 0343-286 SSP IN.

EVAPORATIVE CONDENSER

North Star Ice Equipment Co (I) Pvt. Ltd., 5 Krishna Kunj, 64, 31 Erandwane, Pune 411 004. Tel: 340973, 348241. Fax: 0212-348241.

EXTRUDERS, SNACKS/ VERMICELLI

Fabdecon Engineers — See under "Agitators".

FABRICATED EQUIPMENT

Cosywo Engineering Company — See under "Chemical Plant & Equipment".

Fabdecon Engineers — See under "Agitators".

Food Tech Engineers — See under "Machinery, Food & Beverage Processing".

Frigmaires Engineers — See under "Agitators".

Techno Equipment — See under "Food Processing Equipment/Plant".

Vipul Engineering Equipment — See under "Kitchen Equipment".

FERMENTORS

Pharmalab Engineering Pvt. Ltd. — See under "Process Plant/Equipment".

FIBRE GLASS ADHESIVE TAPE

Unnati Corporation — See under "Adhesive/Tapes, PTFE, Glass".

FILLING MACHINES, AERATED WATER/SYRUP

Autopack Machines Pvt. Ltd. — See under "Bottle Filling & Sealing Machines".

FILLING MACHINES, LIQUID

Bombay Engineering Industry — See under "Filling Machines, Powder/Granules".

FILLING MACHINES, PASTE

Autopack Machines Pvt. Ltd. — See under "Bottle Filling & Sealing Machines".

Bombay Engineering Industries
-- See under "Filling Machines,
Powder/Granules"

FILLING MACHINES, POWDER/GRANULES

Autopack Machines Pvt. Ltd. --
See under "Bottle Filling & Seal-
ing Machines"

Bombay Engineering Industry,
Rm. No. 6 (Extn). Sevantibai
Bhavan, Chimatpada, Marol Naka,
Andheri (E), Bombay 400 059. Tel:
8369368, 8215795. Fax: 91-22-
8327448.

Shirsat Electronics, 133 Dewan
Indus. Estate No. 6, Vasai Rd. East,
Thane 401210. Tel: 8010250, Fax:
(22) 8010250.

FILLING & SEALING MACHINES

Acmevac Sales Pvt. Ltd. -- See
under "Bottle Washers & Rinsers".

Fabdecon Engineers -- See un-
der "Agitators".

Food Tech Engineers-- See un-
der "Machinery, Food & Beverage
Processing"

Frigmaires Engineers -- See
under "Agitators".

Mamko Process Equipment
Manufacturers -- See under "Emul-
sifiers".

New Indo International (Regd.)
-- See under "Pillowpack Packing
Machines".

Samarpan Fabricators Limited,
Plot A-182/A-183, Road 16/Z,
Wagle Industrial Estate, Thane 400
604. Tel: 5321842/5320373/
5320029. Grams: PROPAC. Tlx:
011-72329 SFL IN. Fax: 91-22-
5320033.

Unique Flexo Packaging, Gala
No. B/270, Joshi Wadi, Off
Manpada Road, Dombivli (E),
Bombay 421 201. Tel: 5785723

FILLING MACHINE CONTROLLER

Preci-Tech Weighing Systems,
35 Gokul, M.G. Rd., Borivali,
Bombay 400 066.

FILM, FLEXIBLE LAMINATED

Samarpan Fabricators Ltd. --
See under "Filling & Sealing Ma-
chinery"

FILM, PLASTIC/METAL- LIZED

Noble Polymech Corporation --
See under "Machinery, Packag-
ing"

Petrox Private Ltd. -- See un-
der "BOPP Film"

FILM, MULTILAYER

Rotoflex Industries Ltd., 2nd
Fl., Asarpota Chambers, C.G. Rd.,
Navrangpura, Ahmedabad 380
009. Tel: 461020, 423940, 406766.
Fax: 91-79-463444.

FILTERS

Food Tech Engineers-- See un-
der "Machinery, Food & Beverage
Processing"

Kumar Process Consultants &
Chemicals Pvt. Ltd., 230/4 Ashoka
House, 'Swastik' Behind Puranmal
Delhiwala Linking Rd., Bandra
(W), Bombay 400 050. Tel:
6432512/6420637/6451964. Tlx:
011-75973 KPCC IN. Fax: 091-
22-6432512.

Sharplex Agro Process (I) Pvt.
Ltd., 302 Hill View, Ind. Est., LBS
Marg, Ghatkhopar (W), Bombay
400 086. Tel: 5172606, 5172108,
5173808. Fax: 91-22-517 1239.

FILTERS, WATER

Hitech Ultraviolet Pvt. Ltd. --
See under "U.V. Water Disinfec-
tant System"

FILTER CLOTH/FABRIC

Thor Systems -- See under "Air/
Dust/Fume Control"

FILTER HOUSINGS/CAR- TRIDGES

Ace Marketing Company, 222
Shah & Nahar (A2), Lower Parel,

Bombay 400 013. Tel: 4944942
49459547. Fax: 91-22-49 54250

Manoharlal Mahabirprasad, 22,
Madan Mohan Tala Street,
Calcutta 700 005. Tel: 555-03921/
554/881/3073. Fax: 91-33-
5357739/2479166

FILTER PAPER

Lab Instruments -- See under
"Heating Mantles".

FILTRATION SYSTEMS

Kumar Process Consultants &
Chemicals Pvt. Ltd. -- See under
"Filters".

Pharmaco Machines -- See un-
der "Bottle Washers & Rinsers"

FISH PROCESSING PLANT

Industrial Refrigeration Co.
Pvt. Ltd. -- See under "IQF Spiral
Freezing"

Sharplex Agro Process (I) Pvt.
Ltd. -- See under "Filters"

FLOW METER

Fisher-Rosemount (India) Ltd.,
26 Maker Chambers VI, 2nd Fl.,
Nariman Pt., Bombay 400 021.
Tel: (022) 2874 758/89, 2851066,
2851774, 2851734, Tlx: 011-
83757 JSGR IN, Fax: (022) -
2870502.

FLUID BED DRYERS

Flora Engineering Co. -- See
under "Ovens, Industrial".
Pharmaco Machines-- See un-

der "Bottle Washers & Rinsers"

The Bombay Enggn. Works --
See under "Tray Dryers"

FLUID PROCESS APPLI- CATION

Alweyn Pumps & Systems Pvt
Ltd., 62 Apollo Indl. Estate, Opp
Mahakali Caves Rd., Andheri (E).
Tel/Fax (022) 836 2688/821 4026/
Gr: Alweyn Fam Bombav 59

FLY KILLERS, ELECTRIC

Opel Industries, 235-A, Adyar
Industrial Estate, Sun Mill Com-
pound, Lower Parel, Bombay 400
013. Tel: 4924123, 4926884
4824123, 4926884. Fax: (022)
4926884.

Pest Control (I) Ltd. -- See un-
der "Air Curtains"

FOOD CUTTING EQUIP- MENT

Gadekar & Associates Pvt. Ltd.,
304 Sector 21A, Faridabad 121001.
Tel/Fax: 0129 21 0996.

Lithotech Engineers -- See un-
der "Size Reduction Equipment"

FOOD PROCESSING EQUIPMENT/PLANT

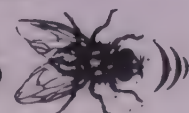
See also "Machinery, Food
& Beverage Processing"

Bajaj Maschne (P) Ltd., 21
Kanti Nagar, P.O. Krishan Nagar,
Delhi 110 051. Tel: 2220828,
2431660. Fax: 91-11-8954995.

Baker Enterprises -- See under
"Bakery/Biscuit Equipment"

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Andheri (E), Bombay 400 059
Tel.: 8217385, 8213546, 8213647 Fax: 8221647

BEC Foods, 31 Maker Chambers III, 3rd Flr., Nariman Pt., Bombay 400 021. Tel 2043647, 2831724, 2871331, Tlx : 011-84054 BECO IN, Fax : 022-2873611.

Cantech Machines -- See under "Can Closing & Seaming Machine".

Fabdecon Engineers -- See under "Agitators".

Filtron Engineers Ltd. -- See under "Dairy Plant & Equipment".

Food Tech Engineers -- See under "Machinery, Food & Beverage Processing".

Geeta Food Engineering, Ashirwad Complex, Vashi Village, Behind Starling Hospital, Gala No. 2, New Bombay 400 703. Tel: 022-7667069. Fax: 91-22-7667069.

Goma Engineering Pvt. Ltd. -- See under "Beverage Processing Machinery".

Hi-Tech Systems, 80, Hardwar Road, Dehradun 248 005. Delhi Office: C-9B, Gangotri Enclave, Alakhnanda, Kalkaji, New Delhi 110 019, H.O. 25853 D.O. : 6436772. Gr: ATMA.

Industrial Refrigeration Pvt. Ltd. -- See under "IQF Spiral Freezer".

Inventure India, 24 Gold Fields Plaza, 45 Sassoon Rd., Pune 411 001. Fax: 0212-621534.

M.F. Marketing, B-104 Arjun Centre, B.S. Devshi Marg, Govandi 400 088. Tel : 5560947/5557515. Gr: STEAMSET. Fax : 91-22-5560569.

Metal Plants -- See under "Contra-Rotary Mixers".

'METACOLOR', Shree Precoated Steel Ltd. -- See under "Refrigeration Equipment & Plant".

Paul Air Engineers Pvt. Ltd. -- See under "Valves".

Santosh Engineering & Fabricators -- See under "Boilers".

Techno Equipments, Saraswati Sadan, 31 Parekh St., Bombay 400 004. Tel: 3851258, 5515640. Gram: FOODEQUIP, Bombay 4.

FORM-FILL-SEAL MACHINES

Autopack Machines Pvt. Ltd. -- See under "Bottle Filling & Sealing Machines".

Grip Engineers, 7/8, Meghwadi Naka, Opp. Maratha Mandir Co-op. Bank, Megh Wadi, Jogeshwari (East) Bombay 400 060. Tel : 645 5103/6455079

Rajhans Enterprise, No. 101 Sai Deep Shopping Centre, Chembur Govandi Rd., Opp. Vaishali Hotel, Chembur (West), Bombay 400 071. Tel: 5557574. Fax: 5160769.

Samarpan Fabricators Ltd. -- See under "Filling & Sealing Machines".

Unique Flexo Packaging -- See under "Filling & Sealing Machines".

FREEZE DRYERS

Pharmalab Engineering India Ltd. -- See under "Process Plant/Equipment".

FREEZERS

General Air Conditioning Co. -- See under "Cold Storage Plant/Equipment".

Industrial Refrigeration Pvt. Ltd. -- See under "IQF Spiral Freezers".

FRUIT CRUSHER

Techno Equipments -- See under "Food Processing Equipment/Plants".

FRUIT JUICE BOTTLING PLANT

Sangram Engineering Pvt. Ltd. -- See under "Turnkey Plants/Projects".

FRUIT & VEGETABLE PROCESSING PLANT/MACHINERY

Eastend Engineering Co., 173/1 Gopal Lal Thakur Rd., Calcutta 700 035. Tel: 526324, 523416.

Goma Engineering Pvt. Ltd. -- See under "Beverage Processing Machinery".

Industrial Refrigeration -- See under "IQF Spiral Freezers".

Orbit International Technologies Pvt. Ltd. -- See under "Machinery, Potato Processing".

SSP Pvt. Ltd., 13 Mile Stone, Faridabad 121 003. Tel : 0129-277442/275968/277730. Fax : 0129-277441/011-6847665.

Sangram Engineering Pvt. Ltd. -- See under "Turnkey Plants/Projects".

Techno Equipments -- See under "Food Processing Equipment/Plant".

GAS/OIL BURNERS

Classic Enterprises, 101 Jehangir Mansion, Cinema Rd., Behind Metro, Bombay 400 020. Tel: 2088291, 2058916 Fax: 91-22-2080404.

GLASS & GLASSWARES

R.G. Glass Industries -- See under "Bottles & Jars, Glass".

GLASS FABRICS, PTFE COATED

Unnati Corporation -- See under "Adhesives/Tapes, PTFE, Glass".

GRAINS & CEREALS CLEANING/GRADING MACHINERY

Forsberg Agritech (India) Pvt. Ltd. 315, Race Course Towers, Race Course Circle, Baroda - 390 015. Tel: (0265) 340597. Fax: (0265) 338150.

Goldin (India) Equipment Pvt. Ltd. 1st fl., Saraswati Industrial Estate, Opp. Chhani Jakat Naka, Vadodara 390 002. Tel: (0265) 481452. Fax: (0265) 481452.

GRANULATOR

Lithotech Engineers -- See under "Size Reduction Equipment".

GRAVITY SEPARATOR

Forsberg Agritech (India) Pvt. Ltd. -- See under "Grains & Cereals Cleaning/Grading Machinery".

Goldin (India) Equipment Pvt. Ltd. -- See under "Grains & Cereals Cleaning/Grading Machinery".

GRINDER, WET & DRY

New Canara General Stores, 178 Dr. Babasaheb Ambedkar Rd., Byculla, Bombay 400 027. Tel : 3722031.

Sesa Pulverisers, Kala Kila Road, Dharavi, Bombay 400 017. Tel: 4121434.

GRINDING MILLS

Frigmaires Engineers -- See under "Agitators".

Sesa Pulverisers -- See under "Grinder, Wet & Dry".

GUM BOILING PANS

Cosywo Engineering Company -- See under "Chemical Plant & Equipment".

HEAT EXCHANGERS

Arctic India Sales -- See under "Dehumidifiers".

Excelsior Engineers -- See under "Cooling Towers".

Food Tech Engineers -- See under "Machinery, Food & Beverage Processing".

Praj Industries Ltd., Process Equipment & Systems Div., 103 & 203 Erandwane Indl. Area, Off

Karve Rd., Opp. SNDT College, Pune 411 038. Tel : +91-212-361013. Fax : +91-212-363039.

HEATING ELEMENTS

Subhash Gupta & Co., A-45 Nand Gram, Meerut Rd., Ghaziabad 201 003. Tel: (0575) 8-733866. Fact: (011) 2293795.

HEATING MANTLES

Lab Instruments. Ratnadeep, 1st Floor, 78, B. Jaganath Shankar Seth Rd., Behind Panchratna, Near Roxy, Opera House, Bombay 400 004. Tel: 3610973. Fax: 3634619.

Manikant Bros. -- See under "Anti-Corrosion Chemicals".

Subhash Gupta & Co. -- See under "Heating Elements".

HOMOGENIZERS

Cosywo Engineering Co. -- See under "Chemical Plant & Equipment".

Dairy Den (India) Pvt. Ltd., 25 Madhuvan, Ellisbridge, Ahmedabad 380 006. Tel : 461205/449538. Fax : 079-443537. Tlx : 0121-7157 DDPL IN.

Fibre & Fibre Products -- See under "Stirrers".

Goma Engineering Pvt. Ltd. -- See under "Beverage Processing Machinery".

Indrayani Agro Industries Pvt. Ltd., D-56 MIDC Additional Industrial Estate, Ambad, Nasik 422010. Tel : 382483. Fax : 381267.

HUMIDIFIERS

Arctic India Sales -- See under "Dehumidifiers".

HYDROMETERS

Industrial Instruments Co. -- See under "Temperature Indicators/Controllers".

HYGROMETERS

Industrial Instruments Co. -- See under "Temperature Indicators/Controllers".

ICE CUBE MACHINE

Dairy Den (India) Pvt. Ltd. -- See under "Homogenizers".

ICE MAKING MACHINERY

Industrial Refrigeration, 9th Fl., Maker Chambers, V. Nariman Point, Bombay 400 021. Tel: 2041183, 85, 89, 2872363, 2872379. Gram: KOOLFAST. Tlx: 011-84130 RUIA IN/ 011-84275 INCO IN. Fax: (91-22) 2044944.

ICE CREAM MAKING MACHINES

Akshay Industries -- See under "Milk Shake Machines"

Goma Engineering Pvt. Ltd. -- See under "Beverage Processing Machinery"

The Panchal Workshop, P.B. No. 62, Anand Sojitra Rd., Anand 388 001. Tel: (02692) 34332, 34399. Tlx: 0172-251 VUIA IN Fax: (02692) 34332/46454

IMPULSE SEALERS

Sarlech Electro Systems, 14462/1 Bhagwan Nagar, Near Savitri, Complex, G.T. Rd., Ludhiana 141003. Tel: 531444; Gram: SARLEHEAT. Tlx: 0386-384 PSIC-IN-ATTN. Fax: 091-161-532871.

Swastik Packaging, 4 Dev Sadan, Chimatpada, Behind Hotel Ruby, Marol Naka, Andheri (E), Bombay 400 059. Tel: 8324673, 8341340. Fax: 91-22-8388198.

INDUSTRIAL GAS MONITORS

Subtronics, Kaliandas Udyog Bhavan, Unit No. 147, Near Prabhadevi H.P.O. Bombay 400 025. Tel: 4224461/4303047

INSECTICIDES

Ultima Search, Excel Estate, S. V. Road, Goregaon (W), Bombay 400 062. Tel: 8751618, 8724174.

INSECT KILLERS (Insectocutors, Electric)

Opel Industries -- See under "Fly Killers, Electric".

Pest Control (India) Ltd. -- See under "Air Curtains".

Varun Industries, Opp. Portuguese Church, Dadar (West), Bombay 400 028. Tel: 4304850. Fax: 4362283

INSTRUMENTS, INDUSTRIAL AND PROCESS CONTROL

Lab Instruments -- See under "Heating Mantles"

INSTRUMENTS, TESTING

Ion Exchange (India) Ltd. -- See under "Water Treatment Plants/Equipment"

IQF SPIRAL FREEZER

Industrial Refrigeration Pvt Ltd., 901 Maker Chambers V, Nariman Point, Bombay 400 021. Tel: 2041 183/85/89. Fax: (91-

22) 2044944; Gr: KOOLFAST Tlx: 011-84130 RUIA IN

JERRY CANS

Rajdeep Plastics, 17 Jamnadas Indl. Estate, Dr. R.P. Road, Opp. Jawahar Talkies, Mulund (W), Bombay 400 080. Tel: 5641972. Fax: (0091) 5645833. Tlx: 011-71941 RAJ IN.

JUICE DISPENSERS

Varun Ref-Air, Gala No. 115,

3rd fl., Nahar & Seth Indl. Estate Pannalal Silk Mill Compound LBS Marg, Bhandup (W), Bombay 400 078. Tel: 5647055, 5641599 Fax: 5649890.

JUICE EXTRACTOR

Bombay Industrial Engineers - See under "Machinery, Food & Beverage Processing"

Food Tech Engineers -- See under "Machinery, Food & Beverage Processing".

Geeta Food Engineering -- See under "Food Processing Equipment/Plant"

Techno Equipments -- See under "Food Processing Equipment/Plant"

KETTLES (STEAM JACKETED)

See also under "Steam Jacketted Kettles"

Food Tech Engineers -- See under "Machinery, Food & Beverage Processing"

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UNNATI INDUSTRIES

423, GIDC Tele. Exch. Lane, Odhav, Ahmedabad 382 415.
Tel: 2872277, 2873434 Tlx: 121-6816 ANAR-IN
Fax: 079-2873223

Geeta Food Engineering -- See under "Food Processing Equipment/Plant".

Techno Equipments -- See under "Food Processing Equipment/Plant".

KITCHEN EQUIPMENT

Kitchen Udyog, 112 Reshab Shree House, Commercial Complex, New Delhi 110008. Tel: 570 3616.

Vipul Engineering Equipment, 13th Girish Kunj, Rd., No. 3, Juhu Scheme, Vile Parle (W), Bombay 400 056. Tel: 6145100, 8080692. Fax: 022-4943409.

KITCHEN FOIL

Foil Impex (Bombay) Pvt. Ltd., 66 Bharat Mahal, 86 Marine Drive, Bombay 400 002. Tel: 91-22-2017202/2011401. Fax: 91-22-4950467

KNEADERS

Fabdecon Engineers -- See under "Agitators".

LPG BOTTLING PLANT

Globe Gas Equipments Industry Pvt. Ltd. -- See under "Burners/Fittings, Commercial"

LABELLING MACHINES

Ambica Labelling Pvt. Ltd., Plot No. A/2 Phase II, GIDC, Vatva, Ahmedabad 382 445. Tel: 5831346/5830153. Fax: 079-5835885.

Excel-Techno Engineers Private Ltd., 27 Stadium House, Navrangpura, Ahmedabad 380 009. Tel: 079-6427866. Fax: 079-6427866.

Lab Instruments -- See under "Heating Mantles".

Maharshi Udyog, 4 Ruchi, 36 Swastik Society, Navrangpura, Ahmedabad 380 099. Tel: 409183/452456. Fax: 0272-425456.

LABORATORY EQUIPMENT

Lab Instruments -- See under "Heating Mantles".

LAMINATED PACKAGING FILM

Samarpan Converters Ltd. -- Plot No. -182/A-183, Rd. 16/2, Wagale Indl. Estate, Thane 400 604. Tel: 5321842, 5320822, 5320029. Fax: 91-22-532033.

LEADER LINE CONTROLLER

Tata Honeywell Limited -- See

under "Controllers, Flow, Liquid Level, Temp., Misc"

LUG CAPS

Larsen & Toubro Ltd., (Packaging Div.) -- See under "Bottle Caps & Closures"

LUG CAP SEALING MACHINE

Raj Products & Equipment, P.O. Box 8075, Bombay 400 056. Tel: 8192250, 8192750. Res: 6102035, Fax: 8375628.

MACHINERY, BLISTER PACKAGING

Sarlech Electro Systems -- See under "Impulse Sealers"

Samarpan Fabricators Ltd. -- See under "Filling & Sealing Machinery"

MACHINERY, CONFECTIONERY

Continental Equipment India Pvt. Ltd. -- See under "Bakery/Biscuit Equipment"

Fabdecon Engineers -- See under "Agitators".

Frigmaires Engineers -- See under "Agitators".

MACHINERY, FOOD & BEVERAGE PROCESSING

See also "Food Processing Machinery/Equipment".

Bombay Industrial Engineers, 430 Hind Rajasthan Centre, D.S. Phalke Rd., Dadar (C. Rly.), Bombay 400 014. Tel: 411 3999/4114275. Gr: BOMBING, Bombay 14.

Food Tech Engineers, 31A, Ghanshyam Ind. Estate, Veera Desai Road, Andheri (West), Bombay 400 058. Tel: 6269106, 6234718. Fax: 91-22-6267298/6269106.

Industrial Refrigeration Pvt. Ltd. -- See under "IQF Spiral Freezer"

Sangram Engineering Ltd., B-5 Supercon, Opp. ITI, Aundh, Pune 411007. Tel: 366935, 342302. Fax: 349673.

Santhosh Engineering & Fabricators, 33, Bhandup Indl. Estate, Gr. Flr., Pannalal Silk Mill Compd., L.B.S. Marg, Bhandup (W), Mumbai 400 078. Tel: 569 2119, 5612746.

MACHINERY, MEAT PROCESSING

Food Tech Engineers -- See under "Machinery, Food & Bever-

age Processing"

Orbit International Technologies Pvt. Ltd. -- See under "Machinery, Potato Processing"

MACHINERY, PACKAGING

A.M.P. Rose (P) Ltd., 38 Double Road, K.H. Rd., Bangalore 560 027. Tel: +91 (0) 2226227, 2216514. Fax: 91-(0) 80-2216165.

Aarkay Wrapping Machines Pvt. Ltd., 1, Hormuzd, 131, August Kranti Marg, Bombay 400 036. Tel: 3670537, 367-5277. Fax: 91-22-3670217. Gram: CRAFTWORLD.

Autopack Machines Pvt. Ltd. -- See under "Bottle Filling & Sealing Machines"

R.G.K. Enterprises, Madhu Kunj, Vinod Baug, Juhu-Line, Block No. 12, Ground Floor, Andheri (W), Bombay 400 058.

Rathi Industrial Equipment Co. Ltd. -- See under "Size Reduction Equipment"

Recon Machine Tools Pvt. Ltd., 37 Sarvoday Indl. Estate, Mahakali Caves Rd., Andheri (E), Bombay 400 093. Tel: 834973, 8343913. Fax: 022-8361074.

Sarlech Electro Systems -- See under "Impulse Sealers"

Samarpan Fabricators Ltd. -- See under "Filling & Sealing Machinery"

Selall -- See under "Filling Machinery, Bag/Pouch"

Tinmaco Engg. Co. (Bombay) Pvt. Ltd. -- See under "Tin Can Machinery Machine"

Unique Flexo Packaging -- See under "Automatic Form-Fill-Seal machines"

Wonderpack Industries (P) Ltd. -- See under "Bread/Biscuit Packaging Machinery"

MACHINERY, PET BOTTLE MAKING

Packpet Industries, 3-B, Sherbanoo, 111, M.K. Road, Mumbai 400 020. Tel: 2088650, 2088901. Fax: 2068636.

MACHINERY, PIZZA MAKING

Inventure India -- See under "Food Processing Plant/Equipment"

MACHINERY, POTATO PROCESSING

Orbit International Technologies Pvt. Ltd. 404 Taramandal

Complex Secretariat Rd., Hyderabad 500 004. Tel: 241216/597798. Fax: (040) 599068

MACHINERY, SHRINK WRAPPING

See also "Shrink/Skin Wrapping Packaging Machines"

Sarlech Electro Systems -- See under "Impulse Sealers"

Samarpan Fabricators Ltd. -- See under "Filling & Sealing Machinery"

MACHINERY, SOFT DRINKS

Goma Engineering Pvt. Ltd. -- See under "Beverage Processing Machinery"

MACHINERY, TEA BAG PACKING

Packpet Industries -- See under "Machinery, PET Bottle Making"

MACHINERY, TOMATO PROCESSING

Goma Engineering Pvt. Ltd. -- See under "Beverage Processing Machinery"

MAGNETIC SEPARATORS

Perfect Magnets Pvt. Ltd., 14 /1 Vishwabharti Co-op. Hsg Society, Akshay Bldg., V.P. Rd., Andheri (W), Bombay 400 058. Tel: 6212570, 8379336.

MATERIAL HANDLING SYSTEMS

Mac Industrial Systems, C/80, Snehdhara Society, Dadabhai X Road No. 3, Vile Parle (W), Bombay 400 056. Tel: 8215993.

Selvel Conveyors, 17A, & 63C, Balaji Industrial Estate, Hanuman Nagar, Akurli Road, Kandivali (E), Bombay 400 101. Tel: 887 23 03/883 86 63/3899, Fax: 91-022-8870605.

Waghela Brothers -- See under "Conveyors"

MEMBRANE FILTERS

Sanjay Scientific Corporation -- See under "Analytical Instrumentation"

METAL CONTAINERS

Divecha Glass Industries, 249 Bal Rajeshwar Rd., Mulund (W), Bombay 400 080

METAL DETECTION EQUIPMENT

Rathi Industrial Equipment Co. -- See under "Size Reduction Equipment"

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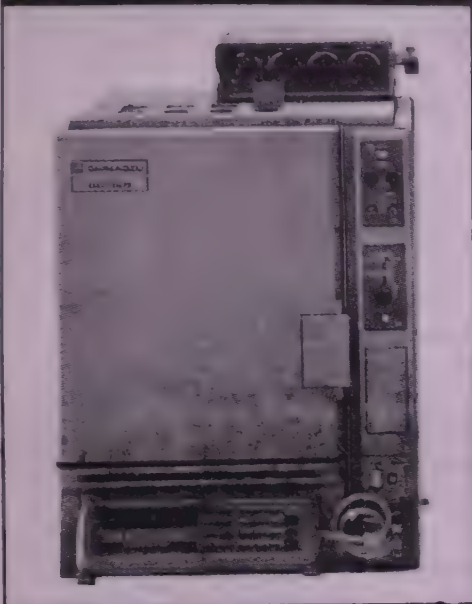
Sanjay Scientific Corporation

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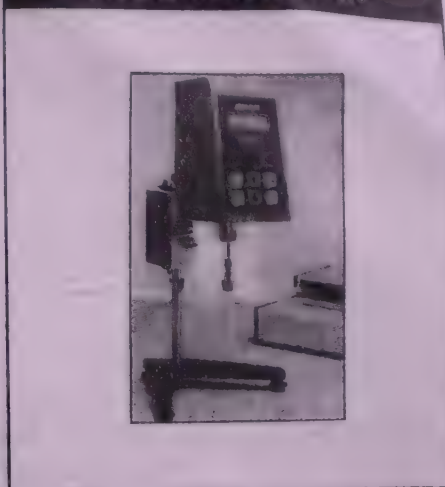
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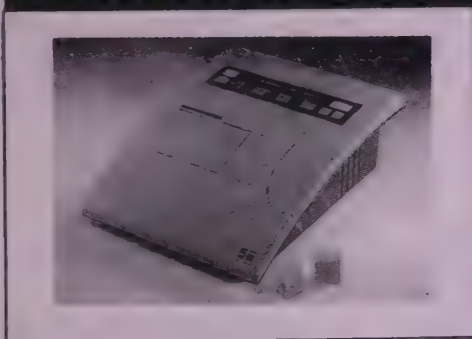
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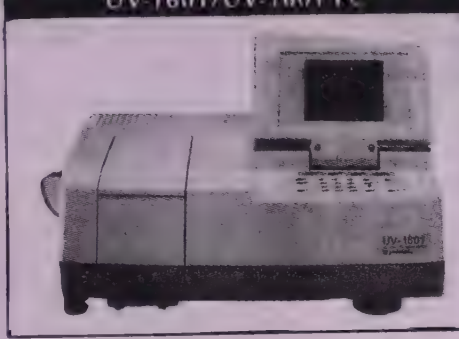
BROOKFIELD DIGITAL VISCOMETER, DV-II+



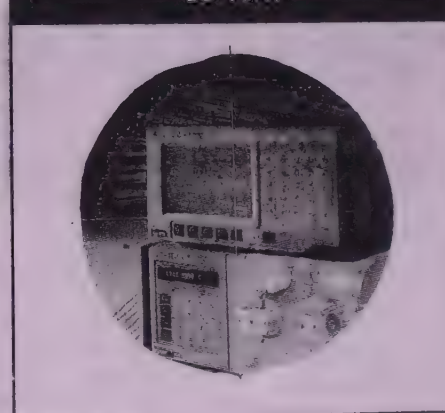
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For further details Please Contact :

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- Scientific Instruments & Equipments
- Membrane Filters Sartorius

B-11/12, Bhiwandiwalla Terrace, Ground Floor, 618, J.S.S. Road, Mumbai-400 002
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MICROBE DETECTION DEVICE

Rakiro Biotech, 27 Sahayog. 3rd Fl., 33/35, R.S. Sapre Marg, Kalbadevi, Bombay 400 002. Tel: 91-22-2095837, Fax: 91-22-3631303.

MILK POWDER PLANT

Goma Engineering Pvt. Ltd.-- See under "Beverage Processing Machinery"

MILK/MILK PRODUCTS PROCESSING PLANT

Food Tech Engineers-- See under "Machinery, Food & Beverage Processing"

Goma Engineering Pvt. Ltd. -- See under "Beverage Processing Machinery"

MILK SHAKE MACHINE

Akshay Industries, 107 Rajeshwari Indl. Area, Chitalsar Manpada, Ghod Bunder Rd., Thane 400 607, Mumbai. Tel: 5375816, 5435838. Fax: 0091-21-5335188.

MINERAL WATER FILLING PLANT

Autopack Machines Pvt. Ltd. - See under "Bottle Filling & Sealing Machines"

Food Tech Engineers-- See under "Machinery, Food & Beverage Processing"

Komal Industries -- See under "Water Treatment Plants/Equipment"

Shriyan Enterprises, 12A Sagar Complex, Bombay - Pune Rd., Kasarwadi Nasik Phata, Pune 411 034. Tel: 779341. Fax: C/o. 0212-779409.

Shivsu Watek (P) Ltd., 14 Spur Tank Rd., Chetput, Madras 600 031. Tel: 8266073/8266083/8266074. Fax: 91-44-8256606.

Venus Packaging Services-- See under "Crown Cap PCV Lining Machine"

MIXERS, INDUSTRIAL

Cosywo Engineering Company-- See under "Chemical Plant & Equipment"

Fabdecon Engineers-- See under "Agitators"

Fibre & Fibre Products -- See under "Stirrers"

MIXERS, POWDER & PASTE

Fabdecon Engineers-- See under "Agitators"

Fngmaires Engineers-- See un-

der "Agitators"

Metal Plants -- See under "Contra-Rotary Mixers"

MOBILE LIFTS (WORK PLATFORM)

Ferro Foundries Pvt. Ltd. Yelwadi Rd., Belvadi, Mysore 571 186. Tel: 42376, 42633. Tlx: 0846-224 HPW IN. Fax: National: 0821-42052.

MUSHROOM PROCESSING PLANT

Food Tech Engineers-- See under "Machinery, Food & Beverage Processing"

Sangram Engineering Pvt. Ltd. - See under "Turnkey Plants/Projects"

OVENS, BREAD/BISCUIT BAKING

Admir Engineers -- See under "Bakery/Biscuit Equipment"

Aifso Enterprises, A/1, Veena Beena Apts., Sewri (W), Bombay 400 015. Tel: Off: 4137339/4130926. Res: 4137109/4134568. Fax: 91-22-4137339.

Continental Equipment (India) Pvt. Ltd.-- See under "Bakery/Biscuit Equipment"

Grovers Pvt. Ltd.-- See under "Bakery/Biscuit Equipment"

Sarlech Enterprises (India) -- See under "Bakery/Biscuit Equipment"

OVENS, INDUSTRIAL

Flora Engineering Co., A-4/A-42, Laghu Udyog Kendra, I.B. Patel Rd., Goregaon (E), Bombay 400 063. Tel: 8735768. Fax: 91-22-2873059.

OVENS/TRAY DRYERS See also "Dryers, Oven/Tray, etc."

Aifso Enterprises -- See under "Ovens, Bread/Biscuit Baking"

Continental Equipment India Pvt. Ltd.-- See under "Bakery/Biscuit Equipment"

The Bombay Engineering Works -- See under "Tray Dryers"

Thermal Instruments & Equipments, 2-1-478 Nallakunta University Road, Hyderabad 500 044. Tel: 41720

OXYGEN ABSORBER

The Panchal Workshop -- See under "Ice Cream Making Machine"

P.P. CAPS

A to Z Bottle Suppliers-- See

under "Bottles & Jars, Glass"

Larsen & Toubro Ltd. (Packaging Div.) -- See under "Bottle Caps & Closures"

P.P. CAPS MACHINERY

Advance Packaging 10/65 Industrial Area, Kirti Nagar, New Delhi 110 015. Tel: 532388, 5410629.

PACKAGING MATERIAL

Divecha Glass Industries (Metal Container Div.) -- See under "Containers, Metal"

Fine Plast Industries Pvt. Ltd., Sarang Street, Taher Bldg, 1st Flr., Bombay 400 003. Tel: 329303/345075. Grams: POLUDRUMS

Plastic International, B/13, Nanddham Indl. Estate, Marol, Andheri (E), Bombay 400 059. Tel: 8320798/8322683. Tlx: 11-79498. Gr: Interplast. Fax: (011) 8366237

Samarpan Fabricators Ltd. -- See under "Filling & Sealing Machine"

W.R. Grace & Co. (India) Pvt. Ltd., 426, 3A Cross, 16th Main, III Block, Koramangala, Bangalore 560 034. Tel: (080) 5534522. Fax: (080) 553 4500.

PALLET HANDLING SYSTEM

Mac Industrial Systems-- See under "Material Handling System"

PASTEURIZERS

MF Marketing Pvt. Ltd., B-15, Arjun Centre, B.S. Devashi Marg, Govandi, Bombay 400 088. Tel: 5557515/5560947. Tlx: MF IN 76502. Fax: 91-22-5560569.

Machinfabrik -- See under "Cookers, Vacuum, Batch"

PASTE & LIQUID FILLING MACHINE

Bombay Engineering Industry, R. No. 6 (Extn) Sevantibai Bhavan, Chimatpada, Marol Naka, Andheri (East), Bombay 400 059. Tel: 836 9368, 8215795. Fax: 022 832 7448.

PET/BOTTLE MACHINERY

East India Paper & Board Mills, 95 Park St., (9th fl.), Calcutta 700 016. Fax: 91-33-292128.

Shivsu Watek (P) Ltd.-- See under "Mineral Water Plant Machinery"

PILLOWPACK PACKING MACHINES

New Indo International (Regd.), 135-A Begumpur, Malviya Nagar,

New Delhi-110 017. Tel: 6445315 6213289, 6217476, 6228290. Fax: 011-6213289/6228290.

Shree Ancillary Industries, B-17, Girikunj Indl. Estate, Off Mahakali Caves Rd., Andheri (E), Bombay 400 093. Tel: 8364914, 8216583. Fax: (91) 22-8379802.

PLANETARY MIXER

Cosywo Engineering Company -- See under "Chemical Plant & Equipment"

Fabdecon Engineers-- See under "Agitators"

PLATE EVAPORATORS

Praj Industries, 1216/6 Fergusson College Rd., Pune 411 004. Tel: 91-212-321/2/3. Fax: 91-22-321689

PLATINUMWARE

Lab Instruments-- See under "Heating Mantles"

PNEUMATIC CONVEYING SYSTEMS

Crystal Automation Pvt. Ltd., Rajshree Ind. Complex, Bldg. No. 1 Unit No. 8 & 108, Behind Lawkin Ltd., Chitalsar, Manpada, Thane 400607. Tel: 532 7592. Fax: 91-22-5322249/5321940.

Rathi Industrial Equipment Co. Ltd.--See under "Size Reduction Equipment"

POUCH FILLING MACHINES

Autopack Machines Pvt. Ltd. - See under "Agitators"

New Indo International (Regd.) -- See under "Pillowpack Packing Machines"

Unique Flexo Packaging -- See under "Filling & Sealing Machine"

POUCH PACKAGING MACHINERY

Wrapid Packaging, Dharamchand Indl. Estate, Deonar Village Rd., Deonar, Bombay 400 088. Tel: 5512138.

POWDER/PASTE BLENDERS

Mamko Process Equipments Manufacturers-- See under "Emulsifiers"

POWDER FILLING MACHINE

See also "Filling Machines, Powder Granules"

Frigmaires Engineers-- See under "Agitators"

PRESSURE GAUGES

Industrial Instruments Co. --
See under "Temperature Indicators/Controllers"

PRESSURE TRANSMITTER

Fisher Rosemount (India) Ltd.
-- See under "Flow Meter"

PROCESS CONTROL EQUIPMENT/SYSTEMS

Fata Honeywell Limited -- See
under "Controllers, Flow, Level,
Temp, etc"

PROCESS PLANT/ EQUIPMENT

Factor Engineering Co. Pvt.
Ltd. -- See under "Demineralisation
Plant/Equipment"

Goma Engineering Pvt. Ltd. --
See under "Beverage Processing
Machinery"

Mamko Process Equipments
Manufacturers-- See under "Emul-
sifiers".

Pharmalab Engineering India
Ltd., Star Metal Compd., L.B.S.
Marg, Vikhroli (W), Mumbai 400
083. Tel: 5782559 (Hunting), Tlx:
11-71934 - PL IN. Fax: 91-22-
5785329

PROCESS PUMPS

Union Enterprise, 113
Nagindas Master Rd., Fort,
Bombay 400 023. Tel: 2671368/
2676560. Fax: 2674071.

PULPER

Bombay Industrial Engineers -
See under "Machinery, Food &
Beverage Processing".

Food Tech Engineers-- See un-
der "Machinery, Food & Beverage
Processing".

Geeta Food Engineering-- See
under "Food Processing Equip-
ment/Plant".

PULVERISERS

D.P. Pulveriser Works, Modi &
Modi Bldg., 76, Nagindas Master
Road Extn., Opp. Maharashtra
State Co-op. Bank Ltd., Fort
Bombay 400 023. Tel: 276435/
274901. Grams: GRANULE

Frigmaires Engineers-- See un-
der "Agitators".

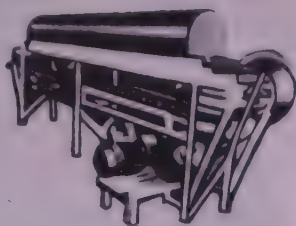
Lithotech Engineers -- See un-
der "Size Reduction Equipment"

PUMPS

Beer, Carbonator, Centrifugal,
Rotary, Vacuum etc.

Alweyn Pumps & Systems Pvt.
Ltd. -- See under "Fluid Process

Manufacturers Of : Food Canning & Processing Machinery Furnaces, Boilers Chemical Plants And Equipments



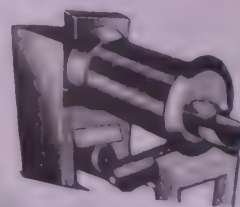
EXHAUST BOX



JUICE EXTRACTOR



JACKET PAN



SUPER-PULPER MACHINE



SANTHOSH ENGINEERING & FABRICATORS

33, Bhandup Indl. Estate, Ground Floor, Pannalal Silk Mill Compd., L.B.S. Marg, Bhandup (W), Mumbai - 400 078.

Phones : 569 21 19, 561 27 46 Cont. : Mr. R.N.Yadav

Application"

Filtron Engineers Ltd. -- See un-
der "Dairy Plant & Equipment"

Flocon Valves & Pumps-- See
under "Valves".

Flotech Industries, C-205 Gokul
Accord, Thakur Complex, Kandivli
(E), Bombay 400 101. Tel:
8873128/8873055. Fax: 022-
8873055

Fristam Pumps (India) Pvt.
Ltd., 117-A, Vithalwadi Rd., Pune-
411 030. Tel: (0212) 440068,
444079. Tlx: (145) 7323 TRON
IN. Fax: (0212) 447949.

Jagdish Engineering Works. 7/
2, Rocky Industrial Estate, I.B.
Patel Road, Goregaon (E), Bombay
400 063. Tel: 8731134. Fax :
8735555

Jyoti Engineers, S/3, Raj
Rajeshwari, Narayan Nagar, LBS
Marg, Ghatkopar (West), Bombay
400 086. Tel: 5127568. Gram:
VARIATOR. Fax: (022) 5164376.

SSP Pvt. Ltd. -- See under
"Evaporators".

Technomech Pumps, Bombay
Wire Compound, Gala No. 10, I.B.
Patel Rd., Goregaon (E), Bombay
400 063.

Union Enterprises -- See under
"Process Pumps"

PUMPS, VARIABLE SPEED DRIVE

Raj Engineers, S/3 Raj Apts.
L.B.S. Marg, Ghatkopar (W),
Bombay 400 086.

REACTORS

Fabdecon Engineers-- See un-

der "Agitators".

REFRIGERATION EQUIPMENT/PLANT

Excelsior Engineers-- See un-
der "Cooling Towers Pumps".

Industrial Refrigeration-- See
under "IQF Spiral Freezer"

Kooling System -- See under
"Chilling Plants"

'Metacolor', Shree Precoated
Steel Ltd., Hanuman Bldg., 308
Perin Nariman Street, Fort,
Bombay 400 001. Tel: 2662540/
2661232. Tlx: 011-82793 YOGI
IN. Fax: 91-22-266 1878.

North Star Ice Equipment Co.
(I) Pvt. Ltd. -- See under "Evapora-
tive Condensators"

RETORTS

Machinfabrik -- See under
"Coolers, Vacuum, Batch"

Techno Equipment-- See under
"Food Processing Equipment/
Plant".

RIBBON MILL

Fabdecon Engineers -- See un-
der "Agitators"

SANDWICH GRILLER

Dairymac Engineering Pvt.
Ltd., 25 Madhuvan, Ellis Bridge,
Ahmedabad 380 006. Tel : 461
205/402 046. Tlx : 121-7157
DDPL IN. Fax : 91-79-443537.

SCREW CONVEYORS

Techno Link Conveyor Sys-
tems, 5 Shirguppe Ind. Estate, 41
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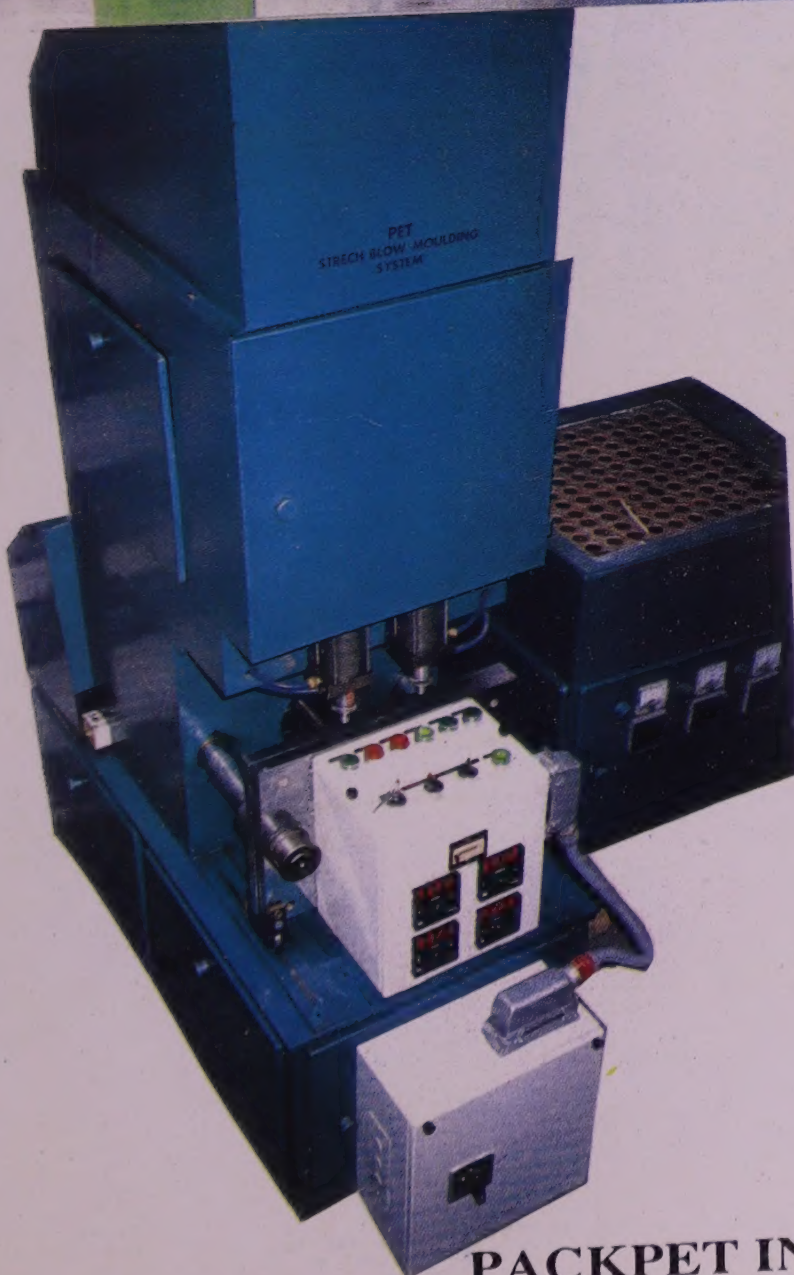
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